UNIVERSITY OF OULU
Department of Industrial Engineering and Management

# SPEEDING-UP NEW PRODUCT DEVELOPMENT VS RAPID DEVELOPMENT

## A holistic comparison

MASTER'S THESIS

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Abstract

Nowadays, the increasing competitiveness inside the markets has ended up in a huge necessity by companies to improve and accelerate the development of new products. It is for that reason that distinguishing the different types of projects and treating them accurately according to their own needs is essential in order to save costs and resources, thus making a good product performance and remaining and even increasing their market share.

In this thesis some theoretical and practical approach is going to be presented about which are the determinant factors in order to decide whether a project requires a whole implementation of New Product Development or whether it needs a fast track process using Rapid Development concept. Therefore, the aim of this thesis is to study which are the main differences and similarities between these two processes, and how these two concepts are understood inside the companies.

This work has been carried out by doing a literature review of the topic in order to define the theoretical framework, and by studying the case of 4 companies, making interviews and analyzing the collected data so as to see how they understand and apply these processes in practice.

As a result, this thesis defines both processes finally making a list of their main determinant factors. Furthermore, it joins these theoretical findings with the data acquired in the interviews detecting that the companies have not a differentiated standardized RaDe process yet although the majority of them understand the importance of having one to improve the company's performance. On the other hand, it has been detected that the companies who have stronger criteria about that concept seem to be the ones who are having less difficulties on building a more defined path to implement a separate process for fast track projects.

Library location

Additional information

*Key words*: New Product Development, acceleration techniques, Rapid Development, holistic comparison, case study.

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**Resumen de la Tesis**

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Resumen

Actualmente, la creciente competitividad de los mercados ha generado una gran necesidad por parte de las empresas de optimizar y acelerar el desarrollo de nuevos productos. Es por esta razón por la cual es esencial distinguir los diferentes tipos de proyectos y utilizar el más adecuado en cada caso para su correcto desarrollo, ahorrando así recursos y costes para mantenerse o incluso mejorar su posición en el mercado.

En esta tesis se va a presentar tanto un marco teórico como práctico relativo a cuáles son los factores determinantes para decidir cuándo un determinado proyecto requiere la completa implementación del proceso de desarrollo de nuevo producto o cuándo necesita una aplicación más rápida y menos compleja de éste. Por tanto, el principal objetivo de esta tesis es estudiar cuales son las principales diferencias y similitudes entre estos dos procesos y estudiar como son entendidos en las empresas.

Este proyecto ha sido llevado a cabo primeramente mediante el estudio de la literatura relacionada con el tema a fin de definir el marco teórico. Finalmente se han estudiado los casos de 4 compañías realizando entrevistas y analizando la información obtenida para ver cómo se entienden y aplican estos conceptos en la práctica.

Como resultado, este proyecto proporciona una definición de estos dos procesos elaborando finalmente una lista de sus principales factores identificativos. Asimismo, une estos hallazgos con la información adquirida en las entrevistas detectando que las empresas aún no tienen un proceso de rápido desarrollo de nuevo producto definido aunque la mayoría comprenden la importancia de tener uno para mejorar su rendimiento. Por otro lado, las compañías que tienen un criterio más elaborado de lo que se considera desarrollo rápido de nuevo producto son las que tienen más allanado el camino para definir e implementar exitosamente estos dos procesos por separado.


Biblioteca


Información adicional

*Palabras clave:* Desarrollo de nuevo producto, técnicas de aceleración, desarrollo rápido de nuevo producto, comparación holística, estudio de casos prácticos.

# Acknowledgements

During this project a deep understanding of the importance and functionality of new product development techniques have been acquired by the author as well as the factors with which distinguish them. Furthermore, the case study has provided a clear view of what is happening right now in companies and has helped a lot to build a complete framework of the studied subject. Therefore, a good and deep knowledge has been acquired with the aim to be able to use it later on, in future projects and during the professional career.

This study has been carried out with the help and effort of people that deserve a special mention.

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# Table of Contents

# 1 Introduction

Since the beginning of the industry, or even before, the society's growth has been carried out by developing new products to satisfy customer's undeserved needs. Actually, in companies these needs could be detected either by sales through a direct customer request or by marketing department, detecting business opportunities of a target market or even creating the need inside it. In any way, since one promising need is perceived by a company, a whole process is started in order to develop sooner and better than their competitors a new product that satisfies this need, thus being in a leading position in the market and getting the maximum revenue. This practice was and is called **New Product Development (NPD).** This concept has undergone waves of changes over the years. The beginning was in the mid-1970 in USA when the industry began to grow up rapidly and the market became more and more competitive. Companies began to realize that development of products was something that could and should be controlled and that a quicker and more agile response to customers' needs was imperative in order to remain in the game. Therefore, NPD began to be studied deeper in order to identify and control all its drivers as well as optimize and standardize the process as much as possible. (Ledwith et al. 2006; Hänninen et al. 2013a)

As the years went by, a more holistic view of that concept was adopted. Researchers found that every new product development project was different and need to apply different techniques but they detect some common patterns that show that some of them could be grouped separately and should be treated differently in order to end up with the best product performance. As a result, they have detected that there are some products that, due to their own nature (novelty, size and complexity, technological risk and knowledge intensity), don't need the whole implementation of NPD process and need to be produced with a fast track one. Therefore, more names like **Rapid Productization (RP)** and **Rapid Development (RaDe)** come into play; more concrete concepts which apply different processes and methods that fit better into these types of products. As the main goal of these processes is creating a new product with which satisfy customers' needs, the concepts are pretty close to NPD and sometimes are difficult to distinguish. (Ledwith et al. 2006)

This issue is becoming increasingly important over the past years as being in a leading position is more and more difficult every day. Nowadays new product development is crucial in responding to increasingly shorter product lifecycles, continuously changing customer demand and pressure to reduce costs and development time. Therefore, knowing how to detect their differences and how to treat them as accurate as possible to save time and costs is an important issue. If we study these concepts deeper, we could see a high difficulty by the companies to understand what the difference between accelerating a whole new product development process and driving a rapid development

one is. Both deal with new products and both require development activities but there is much more than that inside them that makes them completely different processes.(Lin et al. 2012)

Having detected that problem, the main goal of this thesis is to clarify why they are different, how each one of them should be detected and treated within the process in order to not waste money and resources, and how are they actually understood and differentiated in companies. Therefore, the research questions that are going to be answered in that thesis are:

- RQ1: Which are the main factors that determine whether to apply a NPD process or a RaDe process and how are they operated?
- RQ2: How are these two concepts understood and differentiated in companies?

These questions define the main path that that is going to be followed and hence the structure of this thesis:

- First of all a **review on the literature** is going to be made: NPD is going to be defined and analyzed as a whole so as to clarify which are its main characteristics and determinant factors and how can it be speeded up. After this overall analysis, RaDe concept is going to be defined by comparing it with new product development. At the end of this review the main determinant factors are going to be detected and compared between them, thus answering RQ1.
- With all this information acquired a **study of the cases of 4 companies** is going to be made by doing face to face and in depth interviews in order to know how they understand these two concepts and how they treat them as well. A single case analysis is going to be done first. Then, a cross case analysis is going to be made, joining the outputs of the interviews with the factors detected in the literature review and hence answering RQ2.
- Finally the thesis is going to be concluded with an overall view of the work, a critical evaluation of it and some interesting ideas to develop for future researchers on the topic.

# 2 Literature review

## 2.1 New Product Development

### *2.1.1 Definition of the concept*

New Product Development is a complex concept that can be defined by looking into three main frameworks: Process management perspective, decision making point of view, and business perspective.

From a **process management perspective** NPD is a process that is understood as a sequence of steps that have the function to transform a set of inputs into a set of outputs. Therefore, it is defined as a sequence of activities (both organizational and physical) that companies employ to create, design and commercialize a product. This process depends on every company and constitutes part of their competitive advantage as it provides several useful procedures that aim to create a high quality product optimizing time and costs. The phases of this process pass from one to another through gates that include checkpoints and milestones where the state of the product is checked to ensure that is the expected, thus assuring its quality in every phase. To do so, an accurate and articulated planning work has to be done in order to provide to the process: the right coordination of the players, a good management performance identifying possible problems that may appear during the phases, and finally a sensible detection of tasks that could be improved inside it. (Ulrich & Eppinger 2000).

From a **decision making point of view** is the realization of the potential of certain technology into a core product, and finally the transformation of it into an extended product which communicates the real performance and value to the customer (Simula et al. 2008). To do that we have to be aware of the fact that this practice is a deliberate business process that requires making a lot of questions and generating the decisions by answering them. Therefore, it is really important to have a very clear decision perspective with which build them and lead the way of the process. These decisions or these questions can be categorized into two groups: The decisions made within the process (in the operational level) and the decisions that set up the development project (both tactical and strategic level). In every company the nature of these decisions has a clear similarity although the resulting methods and conceptualizations of the final product are clearly different. In other words, the concept of what the product is going to be and the methods to produce it are different but the questions asked by the companies in the process are really close to each other. Furthermore, collecting decisions of issues such as product concept, project schedule or product strategy helps the management team to better understand the structure of the process with which the new product is going to be developed and, at the same time, without getting involved the functional part of how the decisions are made. (Krishnan & Ulrich 2001).

From a **business perspective** NPD is "*the transformation of a market opportunity and a set of assumptions about a product technology into a product available for sale*". In other words, NPD is detecting business opportunities in the market and operating it profitably, bringing products to market on time and optimizing their revenues by reducing cycle-times and costs (Shepherd & Ahmed 2000). The way to do that is by doing a clear business plan that defines the steps to take and continuously assess and adapt it to the changing environment. Nowadays, one factor that should be emphasized is the agility of the process as the actual companies are struggling with the uncertainties of the continuously changing customers' needs and, as a consequence, its need to launch the needed products in the fastest way possible.

Joining these three perspectives we can build the generic NPD concept. It can be understood as the process by which a business opportunity is detected in the market and is exploited through a predefined process with a very clear decision making path to follow until a product available for sale is generated. After defining the general framework of NPD a further study of the process is going to be done in order to better understand its structure and the determinant factors for successfully carrying it out.

### *2.1.2 The Stage-Gate process*

A lot of studies have been made in regards on how to drive a new product development process. As Ulrich and Eppinger said in 2000 it can be understood as a process by which a set of alternative product concepts are being narrowed along the way into more specified concepts since a concrete idea is defined, validated and can be produced an repeated. In other words, this process can be understood like a concept funnel where a lot of ideas coming from different sources like inventors or partners are generated and introduced on it. This funnel is going to eliminate the less interesting ideas, thus keeping the most promising ones by using the development process as the way. Finally, the end of the funnel is going to have the concrete idea and materialization of the final product that is going to be launched in the market. A good representation of this approach is the Cooper's innovation process diagram of 2008 presented in Figure 1.

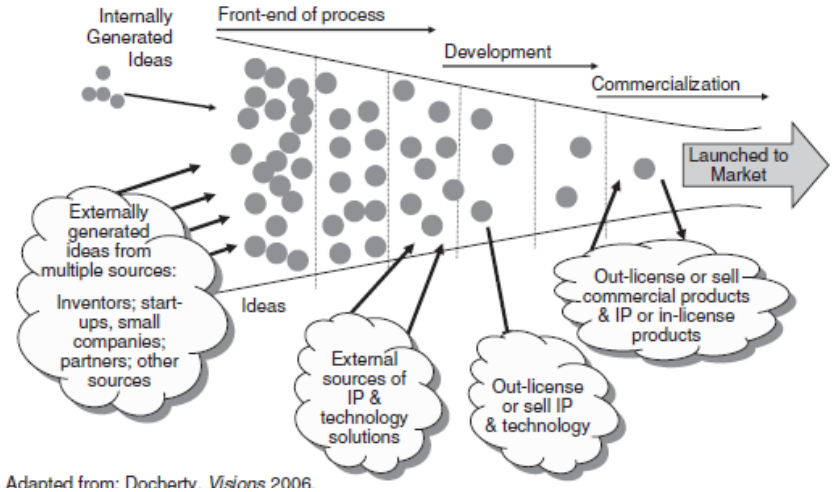


**Figure 1. Cooper's representation of NPD process**

Since this moment we have seen the theoretical approach of what would be the NPD process but, what is the practical application of the theory seen in a managerial perspective? The answer is the ***Stage-Gate*** **process**. This method consists in dividing

the whole process into predefined stages that constitute the blueprint of the project management task. The stages are separated by gates, constituted by go/kill checkpoints that act as a control system to check if the state of the product is the desired in every point of the process.(Cooper 2001).

**The stages**

The stages are a set of activities needed to run the project from a gate to the next one. It has three phases: (1) **Activities**: Gathering information about the project (2) **Integrated analysis**: Analyzing the result of the activities (3) **Deliverables**: Provide the results of the integrated analysis to the gates.(Cooper 2008). These stages are understood by Ulrich and Eppinger in 2000 as an **information processing system** where several of the information is introduced in the process to develop the needed specifications that are going to be delivered to the next phase. More concrete information about this system is shown in Figure 2.


**Figure 2. Information processing system of the stages (Ulrich & Eppinger 2000)**

As we can see, the needed information to drive these stages comes from different departments, thus it has to be well managed so as to have it as clear as possible in order to facilitate the optimal transfer, comprehension and execution of the activities. The data also has to be the needed one, without useless information; *"Many companies collect the data that is available, rather than the data that is needed to help make decisions and run the business"* (Matta & Ashkenas 2003).

Another fact to take into account is that each stage has more difficulty and economic cost than the preceding one; this is the reason why this process is also called an **incremental process**. However, despite the economic cost and difficulty increases while going through these stages, risk decreases as the key uncertainties detected in the early stages are phased out along the way until the product is finally validated. Therefore, at the end of the whole process, the team should have confidence that the product is going to work properly and is going to fit well in the market. (Cooper 2001; Ulrich & Eppinger 2000)

**The gates**

Preceding every stage there is a gate. Every gate constitutes the control point by which the team makes the go/kill decisions. In other words, it gathers the new information about the product's development and decides whether to continue with the next stage, reprioritize or directly kill the project, by making concrete questions and assessing results. These gates also work as a quality control checkpoint and constitute the materialization of the operational part of the decision making path.(Cooper 2001; Ulrich & Eppinger 2000)

## The process

When the stages and the gates are put together the process is generated. This process marks the scheme and schedule to move the new projects from the first idea to the market. Consequently, the application of this concept is different between companies as they have different strategy. In addition, a lot of studies have been made in order to generate a pattern of the stage-gate process. After doing an analysis of the literature the most generic and clear scheme founded is the one of (Cooper 2001) and is going to be explained as follows so as to understand better its functionalities and mark a general starting point for the following study that can be applied to mostly all companies.(Cooper 2001; Ulrich & Eppinger 2000)

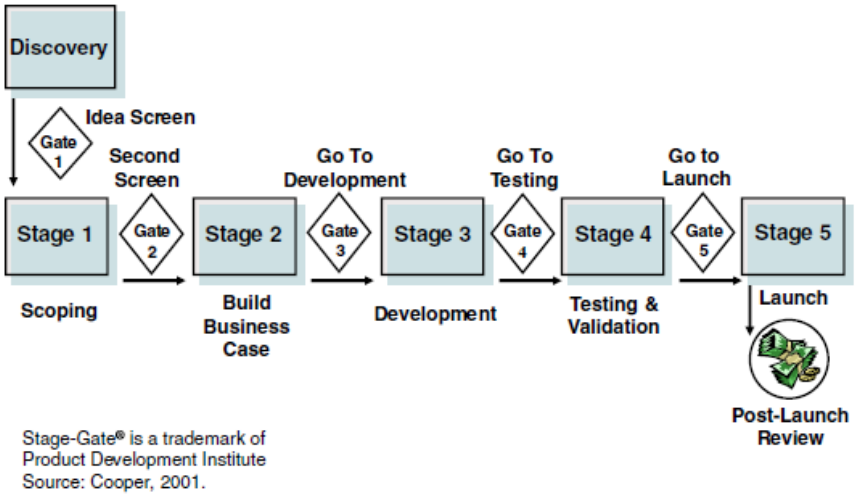


**Figure 3. General Structure of the Stage-Gate process by Cooper 2001.**

As it is shown in Figure 3 this general scheme is a 5 stage process with a stage 0 that encompasses the innovation and also with a final post launch review phase to ensure the quality of the produced good. The overview of this process is explained as follows.

### Stage 0: Discovery

This stage is understood as the creative part of the whole process. It is the one which aims to generate an idea that satisfies a need of a target market, or even generates one need from the scratch and creates the product that is going to satisfy that need. The best practice in this stage would be generating as much ideas as you can in order to have the maximum number of good business opportunities to work with. As the American scientist Linus Pauling said *"The way to get good ideas is to get lots of ideas, and throw the bad ones away"*. This stage is usually driven by marketing and many companies consider it so important that they create a really defined system of idea generation. (Cooper 2001)

The main activities of this stage are the fundamental technical research, the research of new technological possibilities, trying to uncover unmet needs working with lead users, trying to satisfy a need of a customers' direct request, and also trying to discover disruptions in the industry doing a good scenario analysis of the company and the environment. There are some idea generation techniques that are really useful to come up with disruptive ideas. Depending on the company's orientation (market-orientated, technology orientated, product orientated…) the applied techniques are going to be ones or others as the study is going to be focused on different fields. For example, if the

firm is market-orientated it will be more useful to apply techniques which study the tasks and activities practiced by users in order to discover an unmet need (activity analysis). Otherwise, if the firm is competitor orientated it should be more interesting to apply reverse engineering technique; gathering information about the products launched by their competitors and trying to discover the technical specifications usually de-assembling it. In anyway, what is important to remark is that during this stage the ideas could be both inventions and innovations of existing products but all of them have a very high degree of originality that require a huge effort in all the subsequent stages of their development. (Cooper 2001; Conway & Steward 2009)

### Gate 1: Idea screen

When the idea is generated is time to make the first decision in order to commit resources to the project. The idea screen gate asses the strategic alignment, the magnitude of opportunity and market attractiveness, the project feasibility and other related things that help the company make an overview of the quality and opportunities of the idea. This gate is the least strict, as it is the first one, and allows passing all the promising ideas to the next stage. Financial criteria usually don't take part on this first gate, as the project is just born in that point. The key questions of this gate are present in Table 1. (Cooper 2001; Krishnan & Ulrich 2001)

| | |
|---|---|
| *Does the proposed idea **fit** in the company's **strategy**?* | *Is the **technology** needed to develop and produce the product **available** or feasible?* |
| *Have the **market** a good size, growth and **opportunities**?* | *Are there any clear **variables** that could **kill** the project? (Legislative actions, environmental issues…)* |

**Table 1. Key questions for Gate 1 (Cooper 2001)**

### Stage 1: Scoping

When the project is created is time to begin to do research. In this first stage the objective is to assess the market and technological feasibility, and scoping the project by doing mainly desk research. This is usually done by a group of 10-20 people from marketing and from a technical group from R&D, who gathers both market and technical information that enables to have a first picture of the financial framework and the beginning of the product concept as input to gate 2. (Cooper 2001)

A **preliminary market assessment** should be done in that stage. It usually doesn't involve expensive activities; just internet and library research, conversations with the key users and even with potential users. The purpose is to determine more concretely the market size, potential and also begin to build the product concept. Furthermore a **preliminary technical assessment** is done in that stage in order to assess development and manufacturing operations: possible times and costs of execution, legal and regulatory risks… etc. (Cooper 2001)

### Gate 2: Second screen

When all the market and technical information is gathered a more rigorous decision is made in gate 2. The project is reevaluated using the same technical and market criteria of gate 1 but emphasizing in the force of sales, customer reaction to the proposed product and regulatory and killer variables. **Financial return** is also assessed in this gate but not in so much detail, only simple calculations like the payback period.(Krishnan & Ulrich 2001; Ulrich & Eppinger 2000)

In addition, some preliminary **concept development decisions** are taken defining an initial product physical configuration with attributes to satisfy both customer's needs and technical specifications (known by analyzing the market and the technology). The traditional approach of this concept development is to make a fixed concept from the beginning with no option to change it during the development stage. This, however, is changing. It will be seen as more efficient to be flexible in that issue. If necessary, it will select the best design of the product later in the process when the practical issues appear.(Krishnan & Ulrich 2001).

The key questions in this stage would be the same as the ones in gate 1 plus the next ones listed in Table 2 related to the preliminary concept development and financial return:

| | |
|---|---|
| *What is the **core product concept**?* | *What **variants** of the product will be **offered**?* |
| *What is the **product architecture**?* | *What will be the **product's** overall **physical form**?* |
| *What are the **target values** of the product attributes, including price?* | *Which is the expected **payback period** of the investment?* |

**Table 2. Additional key questions for Gate 2 (Krishnan & Ulrich 2001)**

Stage 2: Building the Business Case

When the environment is assessed is time to define how the product is going to be. The idea of the product is evaluated and analyzed in order to help the management team decide rationally the business value of the potential investment. Therefore, in this stage a detailed investigation is carried out in order to clarify which is the product and how attractive it is. This will ensure that the possibility of a heavy investment will be worth it. This is a critical stage that has a huge importance while developing a new product. The economic and time effort put in the project until now has been low compared to what it will be in the subsequent stages where the product is going to be developed. As the change is important the next decision will be important, thus we have to make considerably more effort in that stage, where the needed data to make that important decision is collected. Furthermore, this stage is best handled by cross functional teams of sales, R&D and marketing, as it embraces the whole process. (Cooper 2001; Kinnunen et al. 2013)

Basically, in this stage all the information gathered until now (market and technology assessment, product definition, financial assessment…) is going to be studied further. Therefore, the main activities of this stage are: **Market assessment, Technical assessment, Strategy fit and Financial analysis**. *"During the process the team undertakes predefined work, gathers needed information and does data integration and analysis"* (Kinnunen et al. 2013). A summary of the activities is shown in Figure 4.

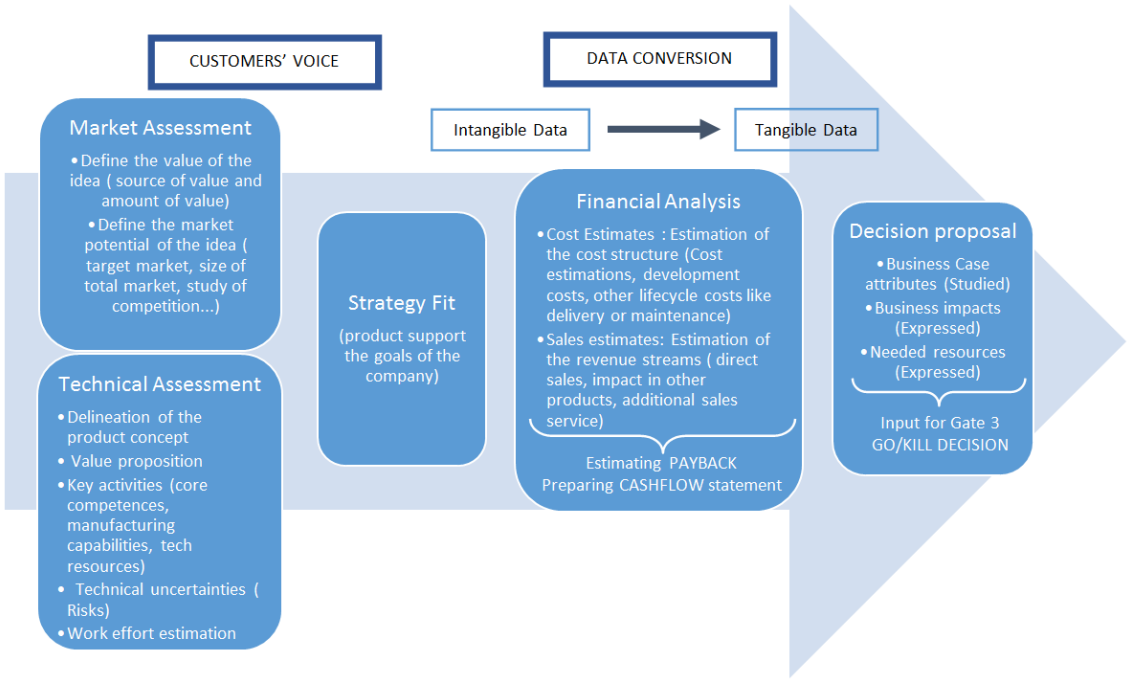


**Figure 4. Business Case analysis process (Kinnunen et.al 2011)**

## Gate 3 Go to development

As noted in the previous stage the decisions made in this gate 3 are really important as it is the last point to kill the project before entering in the phases of heavy spending. Therefore, it requires a much elaborated review of all the studied assessments done in stage 2, checking that all of them have been well done and the results are positive. This gate use again the criteria of the previous ones, now studying with more accuracy and detail the product concept design, and with also an increase on the importance on the financial analysis. (Krishnan & Ulrich 2001; Conway & Steward 2009).

Furthermore, three more issues related to the project plan have to be taken into account and make the respective decisions. The first one is the **product design**, related to "*the specification of the design parameters, determination of precedence relations in the assembly and the detail design of components (including material and process selection)" (Krishnan & Ulrich 2001)*. In other words, it mainly consists in mathematical methods that aim to translate; firstly, customer requirement into technical specifications, and secondly, these technical specifications into the product design. The second one is **prototyping techniques** which aim to find an optimal prototyping and testing strategy that should balance the cost of prototyping and the cost of redesign. Depending on the type of product the management team would choose, one prototyping technique or another would minimize the cost of redesign if necessary and, at the same time, maximize the quality and success of the prototype. The last important issue is the **supply-chain design** understanding this concept as both flow of physical material, and intellectual property and services. In these kinds of products with a high degree of innovation is very common to have a high dependence between the company and the suppliers of certain material or even certain component that is outsourced to them. Therefore a special attention must be taken on who is going to do what, and when and how is going to be delivered and tested. (Krishnan & Ulrich 2001; Conway & Steward 2009).

If the decision is to go, this gate is ensuring a good product definition an agreement on the project plan, the needed preliminary operations and the marketing plan. With these four things determined the last step is the physical development of the product.

The key questions about the additional decisions of this gate (Product design, Supply-Chain design) are listed in Table 3.

| Product Design | Supply-Chain Design |
|---|---|
| *What are the values of the **key design parameters**?* | ***Which components** will be designed outside?* |
| *What is the **configuration of the components** and the assembly relations?* | ***Who will produce the components** and assemble the product?* |
| *What is the **detailed design** of the components (material and process selection)?* | *What is the **configuration of the physical supply chain**?* |
| **Prototyping Techniques** | *Who will provide the **technology and equipment**?* |
| *What is the **prototyping plan** and which **technologies** should be used?* | *Which **process** will be used **to assemble** the product?* |

**Table 3. Additional key questions for Gate 3 (Kirshnan & Ulrich 2001)**

### Stage 3: Development

This stage is the heart of the process and has the function to physically develop the product, implementing the project plan made and accepted in the previous stage. It moreover may be divided into milestones and periodic reviews if the project is big. This stage is basically focused in technical work to develop the product, so quality control is essential. Therefore, there are several tests (i.e. Lab tests and alpha tests) to ensure that the product meets the expectations. This stage is mainly performed by R&D department, even though marketing activities and management operations activities are also undertaken. One example is the continuity of market-analysis and the customer's feedback of the product's prototype which helps management team to see if there is still a good response. (Cooper 2001; Conway & Steward 2009).

The main activity in this stage is **prototyping** but there are some secondary activities that prepare the project for the next stage of testing and launching. They are **test planning, market launch plans** and **production plans**. There should also be some activities to **solve unexpected problems** that could appear during the process trying to find the best solution. In these activities product engineers and designers must work together trying to fix the problems. The most common ones are the related to the product's material, for example selecting the appropriate material for the product and validating it by the engineers regarding the strength, flexibility, resistance…etc. Finally, the **financial analysis** is **updated** with the issues that are resolved and with patents and some other regulations. (Cooper 2001; Conway & Steward 2009).

### Gate 4: Go to Testing

This gate aims to check if the developed product fits in the original definition and if it has been done in a quality manner. This gate also does a review of the financial situation based on the updated data provided from the development stage. Furthermore, the test plans done in the same stage are validated taking into account the prototyping technology that has been selected in Gate 3.The additional key questions for this gate are listed in Table 4. (Krishnan & Ulrich 2001)

| | |
|---|---|
| *What is going to be the **plan for testing**?* | *Which are going to be the **testing technologies**?* |

**Table 4 Additional key questions for Gate 4 (Krishnan & Ulrich 2001)**

Stage 4: Testing and Validation

As the name suggests, this stage is the one in which the project is tested: The product, the production process, customer acceptance and financial assessment. It is the last stage before the mass production of the product, thus it analyzes the entire viability of the process to be sure that the results are the expected ones. If the results are negative, the project goes back to stage 3 beginning an iterative process of developing and testing since the product is finally validated. It is performed by R&D department as the tested things are technical issues. (Cooper 2008; Krishnan & Ulrich 2001)

The main activity of this stage is: **in-house testing** (alpha or lab tests to ensure product's quality and performance), **user trials** of the product (to measure the potential customers' reaction), **pilot production** (to improve the production process and determine production costs more precisely) and **trial sell** (to measure the effectiveness of the launch plan and determine expected market shares). As always, it is also a **business and financial analysis** of the project to check the business and economic viability of the process. This is based in more accurate information of the expected costs and revenues. (Cooper 2008; Krishnan & Ulrich 2001)

Gate 5: Go to launch and delivery

This is the last gate of the process and is the one before marketing launch and the production of the product; is the door that opens the project to the product's full commercialization. Therefore, it is the final point where the project can be killed and it has to be accurately studied. The main criteria is to *"define the degree to which test marketing should be done, and the sequence in which products are introduced in different markets"* (Krishnan & Ulrich 2001). A critical decision regarding to this last topic is the preannouncement of a launch date of the product, otherwise the value of the firm is going to suffer. As the last gates, this one also has the goal to check all the results of the tests done in the last stage focusing mainly in the financial return of the investment and in the review of the operational and marketing plans that are going to be implemented in the next stage.(Cooper 2001; Krishnan & Ulrich 2001). The additional key questions for this gate are listed in Table 5. (Cooper 2001; Krishnan & Ulrich 2001)

| | |
|---|---|
| *What is going to be the **plan for market launch**?* | *What is the **plan for production ramp-up**?* |

**Table 5 Additional key questions for Gate 5 (Krishnan & Ulrich 2001)**

Stage 5: Launch and delivery

The launch stage is the final stage of the whole process, it is driven by sales and marketing, and is the one where the product is mass produced and launched into the market. Here the marketing launch plan and the production or operations plan are implemented. The key activities are driving a **good plan of action**, **providing** it with the **needed resources** and trying to **fix** as rapid as possible the **unexpected issues**. If it is all well done the product should succeed. (Cooper 2001; Krishnan & Ulrich 2001)

Auxiliar Stage/Gate: Post launch review

This last phase of the project aims to assess the performance of the product on the market and to compare the real financial results with the ones estimated during the project. Here the project team also assess how the project was carried out, which were its strengths and weaknesses and what did they learn about it, in order to improve the process in the next project. Furthermore, a research on the customer's satisfaction is done in order to be sure that they have what they expect and some ways with which improve the product. After talking with customers, it is common that management team decides to carry out a new project that makes a new version of the product. These projects have low degree of innovativeness so they can't be put into NPD's box, but they are done in a long term as there is no urgency to have them ready for a certain customer; they are merely actualizations of the product in order to remain competitive into the market in long term.(Cooper 2008)

### *2.1.3 The decision making framework*

**Product portfolio management**

After having studied the structure of NPD process it can be perceived that there is one important part of the process that seems to have an important role for the good process performance, this is the decision making approach and criteria. (Jeffrey et al. 2001) The decisions made within the project have been explained in the last point as they are located in the gates. These basically center their attention on each individual project, they kill the poor ideas and they allow passing the good ones. However, inside a company is normal to have more than one product development project being carried out at the same time. Consequently, there is an important factor here that has to be taken into consideration, the resources are limited, and thus not all the good ideas are able to be developed. Is because of that reason that a more general decision making framework is needed in order to coordinate the simultaneous projects; organizing them inside the firm's organization. This decision making framework is called product portfolio management.(Krishnan & Ulrich 2001)

This important set of decisions that embraces product portfolio management are about making strategic choices which materializes the business strategy, and making product and technology choices that determine how the business will look like in 5 years. They also deal with the limited resources allocation in every ongoing project trying to balance them in the best way possible, thus prioritizing the most promising ones and leaving the others in second frame or even killing them. In regards of when this activity kicks in the stage-gate process there is not a defined moment but they usually are located in the time where the heavy investment of money, time and resources are made. So, it is usually located between the stage 2 of the business case definition and the subsequent gate 3 where the decision of whether to develop the product or not is made.(Cooper 2001; Cooper et al. 1999)

In addition, there are three main approaches while selecting and evaluating these projects in the gates. The first one is the benefit measurement technique that applies methods using subjective assessments such as fit with the corporate objectives of the firm, competitive advantage, and market attractiveness. The second is the financial or economic models that use conventional data like projected sales, gross margins and costs. Finally the third approach is portfolio methods, as the portfolio management considers the entire set of projects as a whole instead of each one in isolation. There are many tools of this project selection methods using different criteria to allocate money and resources to the projects; Financial or economic methods, fit on business strategy,

bubble diagrams that categorize the project according to different factors that could be for example probability of technical success and the amount of reward, scoring models, and checklists. It has been detected though that the mathematical models to assess project's importance are more inefficient than the ones using a mixed qualitative and mathematical methods. That is because mathematical models often do not provide an accurate study of the interrelationships of the different determinant factors, thus there is important information that is missing.(Cooper 2001; Cooper et al. 1999)

In conclusion, this task is pretty complex, embracing difficult models that require a considerable amount of time and resources. However, it has to be performed in the best way possible as the quality of this portfolio management is a determinant factor for the company's success due to the huge uncertainty of how the new products are going to perform in the market. (Cooper 2001; Cooper et al. 1999).

**The Gatekeepers, involving a cross functional practice**

Since this moment the study has been focused on which are the decisions that have to be made during the process of new product development, but a special attention has to be taken into the people who carry out this process and who make the decisions. When the gates were explained this people where called "the management team" but here isn't any explanation about who they really are and if they are the same in every gate and every decision.(Cooper 2008)

First of all is important to mention that these people have the authority to make the important decisions such as reallocating resources, and initiating, cancelling or reprioritizing projects. They come from the highest part of the firm's pyramid, they are the heads of the firm and thus they are called management team. Besides making the decisions this group of people is the responsible of establishing the vision of the company and thus setting the strategy, lead their workers by motivating them in order to improve every day, and recruit the best staff. (Cooper 2001; Cooper 2008; Krishnan & Ulrich 2001)

Secondly, an important issue to emphasize is the functional areas this management team belongs. Actually companies are organized into **cross-functional teams** that perform different kinds of activities. In general terms, marketing is responsible of generating the demand whereas operations are responsible of fulfilling it. However, while driving a new product development process this type of organization is challenging as it has activities that require the active collaboration between different functional areas located in different places. This also happens with the gatekeepers, they constitute a mixed group from different functional areas and they change from gate to gate depending on what is the nature of the decision. For example, in the development stage-gate marketing is responsible of many decisions of product planning whereas operations are responsible for the supply-chain design and, at the same time, R&D department has the task of creating the detailed design of the product. As we could deduce, these activities and decisions are interrelated; maybe the material selected by the engineers of R&D is really difficult to produce and deliver by operation's department, or maybe the last market study remarks on developing the product in a certain color that is more attractive to customers. Therefore, there is a difficulty of assembling all that information and decisions that came from different departments and is for that reason that the coordination between them has to be perfectly performed. This factor has been mentioned before as it is detected to be one of the critical factors of the whole process. Consequently some study has to be done in order to assure this good coordination of the

teams and thus ensuring a good knowledge transfer and, as a result, a good NPD performance. (Cooper 2001; Krishnan & Ulrich 2001; Shepherd & Ahmed 2000; Langerak & Hultink 2008; Drew 1995)

Some practices that are useful in order to manage good team coordination are as follows. It is important to remark that although these measures are focused in the high decision making tasks they can be extrapolated in all the other activities of the process. (Cooper 2001; Krishnan & Ulrich 2001; Shepherd & Ahmed 2000; Langerak & Hultink 2008; Drew 1995)

- A good **decomposition of the phases** into activities ensuring a good definition of the responsibilities of every department.
- Make a **good project plan setting targets and goals.** Roadmaps and milestones are needed in order to clarify the tasks of each team and ensure that any key step or key activity is missing, as well as to allocate resources and plan activities faster.
- Trying to **follow continuity** in the decision gates by not completely changing all the gatekeepers from one gate to the subsequent one. This also ensures a better knowledge transfer between the gates as there are some people in a certain gate that have been in the last one and thus know the past information.
- Having good **balance** between top-management control and the cross functional team's execution of the tasks. The process should not be over-controlled leaving no place to team's creativity and pro-activity. Otherwise the team is going to be less motivated and some good ideas could not appear.
- Have good **leadership skills** with which motivate the people and construct a united team with a good environment, continuously training and rewarding employees. This brings on a gain of understanding about the interrelationships between NPD tasks.
- **Hiring new skills** in order to find new and fresh ideas that are the key of innovation.

This last topic of how to manage a project team in a way that improves the entire process opens the door to the next point, how can we accelerate not only the decision making path but also the entire process. More concrete subjects and factors of NPD process are going to be analyzed in order to find techniques, tools or practices that accelerate it, thus saving costs of time, money and resources.

### *2.1.4 How to Speed-Up NPD*

When we talk about accelerating NPD we are referring to some techniques that improve and optimize the process without changing the philosophy and the nature of it but saving money, time and resources, and ensuring quality at the same time. There exists many techniques and skills that enable the acceleration of the process. The most important ones have been summarized into 16 points and have been classified in three main categories: General capabilities that a NPD process should have, techniques considering the project as a whole, and techniques and methods applied within the development process (operational framework).

GENERAL CAPABILITIES OF THE PROCESS:

1. **Flexibility:** The process must be flexible enough to be directed through it according to its own needs and level of risk. Not all the products are the same; they need different treatment depending on their own characteristics. So the

process should have a degree of freedom where the characteristics and methods of the process could change. (Cooper 2001)

2. **Achieve fluidity by overlapping tasks:** Make the gates less strict, creating a "conditional go" in the decision making framework and allowing the project to go through the next stage without having all the results and assessments. In other words, it consists in overlapping stages and so achieving more fluidity in the process with fewer stops. This can be done in these situations in which the expected result is not vital and the project is unnecessarily stopped affecting to the efficiency of the whole process. (Cooper 2001).
3. **Focusing in portfolio management:** Continuously assessing the ongoing projects helps the company to kill the poor projects soon and reallocate the resources to more promising ones. This is a portfolio management's task and constitutes a key factor of the firm's success. Therefore, attention should be made on that subject when driving new product development projects. (Cooper 2001).
4. **Create the figure of the process keeper:** This position is the one who coordinates and controls the entire process, updating information, ensuring the good decision making in every gate, and training the future employees. (Cooper 2001).
5. **Always updating:** It is important for remaining competitive to be actualized of the last methods and tools that improve the process in order to reduce costs and increase the profits. Actually, companies are dedicating a part of their resources to investigate some technological improvements for their own processes so as to have competitive advantage among the other companies. (Cooper 2001).

<u>THE PROJECT AS A WHOLE</u>

1. **Start the project early:** When setting up a project often the work is done slower; there is more difficulty scheduling and arranging meetings because it is new and unknown. It is also the beginning and most of the teams are not cohesive and they are not stressed because they have plenty of time ahead. However, if we think about it, saving one month at the beginning or saving it at the end is the same so it is important to start the project as fast and soon as possible. Furthermore, accelerating the project before its kick off is much easier than trying to speed it up when is on the way. (Ulrich & Eppinger 2000).
2. **Kill as much projects as you can in the early phases** in order to not spend so much money on them and allocate that money and resources to the most promising ones. This can be done by studying deeper and better the business opportunity and accelerating the decision making phases. Definitely, this will be achieved well managing the firm's product portfolio. (Krishnan & Ulrich 2001).
3. **Manage the project scope:** Usually, while developing a product, there is tendency to add additional features to the products. This is risky as it should end into the production of a good product without a market. Therefore, the management team must have the capability to "freeze" the design of the product in order to maintain the original concept and don't lose the way.(Ulrich & Eppinger 2000).

<u>WITHIN THE DEVELOPMENT PROCESS:</u>

These next techniques are the ones referred to the operational part of the process, mainly focused in the development stage. The two main resources to minimize here are money and time, ensuring at the same time the best quality of the product. Specifically

the two aspects to be reduced are product development costs and the product's time to market. Structured tools are implemented to help optimizing direct or indirectly both concepts, as saving time you end up saving money and vice versa. However, managers have to find a balance in that field between implementing these structured techniques and maintaining flexibility and innovation at the same time.

1. **Improve the efficiency** especially in manufacturing and engineering areas. An increasing productivity means reducing product development's costs. This can be achieved by applying hardware-based methods in order to **standardize the process** with defined steps **and make it modular** with relatively autonomous phases that can perform in parallel in some cases but with close relationship between them. (Krishnan & Ulrich 2001; Jacobs et al. 2011).
2. **Complete tasks of the critical path quickly,** usually is possible by quickly detecting and starting the critical task. It can also increase the efficiency to overlap some critical tasks, brake them off in smaller activities, and outsource some tasks if the process is new and slow.(Ulrich & Eppinger 2000).
3. **Aggregate safety times** using buffers at the end of the project instead of applying them in every task. These safety times are the ones that are used in case of unexpected problems and delays. Putting this extra time at the end helps the team to try to follow the schedule of the tasks as accurate as possible. (Goldratt 1997) found that the tasks are planned to be finished at the time of the schedule and not before, even if this extra time is included on it. So the result to put this time in a final buffer would result in a faster execution of the tasks, leaving this safety time for real unexpected issues.(Ulrich & Eppinger 2000).
4. **Reduce design time and cost**, producing products first and hence becoming the first movers. This can be done by for example reducing parts and components of the product. One useful technique to achieve is by **applying a product modular structure**. That concept aims to exploit the similarities among product parts by creating product families that make the manufacture of similar products easier and faster. Separating the product into highly independent parts allows the firm to produce a wide range of products by combining these parts in a high number of ways. It also makes much easier to outsource the production of certain part of the product if needed, providing the accurate specifications faster.(Krishnan & Ulrich 2001; Langerak & Hultink 2008).
5. **Balance the development time** following the U-shaped curve. Lengthening development time will result on losing know-how and motivation on the team members, whereas shortening development time will increase costs due to excessive parallel activities difficult to manage. Therefore, it has to be balance between the required time to develop a new product and the ability to have it ready when the market is ready.(Krishnan & Ulrich 2001).
6. **Stimulation of inter-functional coordination with cross-functional teams** whose techniques and characteristics were explained in the previous chapter.(Langerak & Hultink 2008).
7. **Supplier and lead user involvement**. The first one reduces the cost as working in collaboration with suppliers joins their knowledge to the project. This allows the company to invest in new technologies working in joint venture with suppliers that can have more expertise on a certain technology. As it has been said before, combining this technique with the application of the modular structure apparently will increase efficiency, as it is easier to subcontract certain part of the product to them.(Danese & Filippini 2013). The second one directly reduces the time because it helps firms to be aware of important need and

solution information. This information usually gathered when designing the product prevents delays in future stages on the NPD process, fosters creativity, and ensures that the product is well received by customers, thus reducing uncertainties. (Langerak & Hultink 2008; Langerak et al. 1999; Schweitzer & Gabriel 2012; Thomke & Von Hippel 2002).

8. **Facilitation of knowledge transfer:** (Murmann 1994) said," *The time employed in NPD is determined by the efficiency of the information process, the levels of uncertainty in development, and the amount of information needed to combine all information elements".* Especially in large companies a good transfer of information between departments is difficult and has to be managed accurately. A good communication between departments will reduce the overall costs by using project resources more efficiently, achieving better coordination of the teams, and hence avoiding work redundancy, errors and lack of information. It will also ensure a better understanding of the project's goals by the team members.(Ulrich & Eppinger 2000; Lin et al. 2012). There are some tools that help the process to overcome the difficulties, misunderstandings and problems of the information transfer:
    a. Making a **review board and schedule the project** to control the overall process with continuous updates of information (Shepherd & Ahmed 2000).
    b. Having **no excessive task interdependence**: It results in complex and inefficient communication channels with bad knowledge transfer and a poor understanding of which are the responsibilities of the players.(Shepherd & Ahmed 2000).
    c. **Applying virtual competences** to improve the effectiveness and the quality of the information exchange. However, this entails challenges that have to be taken into account as these teams are usually cross functional and geographically disperse but they have to work in highly dependent tasks. This geographical or functional diversity together with the high degree of impersonality that a virtual communication entails can cause problems and misunderstandings. Nevertheless, if they are well managed, this fact can provide more diversity and creativity of the ideas, and more speed and less costs in the information exchange. The team also tends not to be as cohesive as it should be and requires some media and social skills to be developed by the team members. Furthermore one critical problem that needs an extra attention is the tacit knowledge because it is the most difficult to transfer virtually as it entails a knowledge that is been acquired usually by practice and not by material information. (Lohikoski & Haapasalo 2013; Zigurs 2002).

A summary of the selected techniques is presented below in Figure 5.

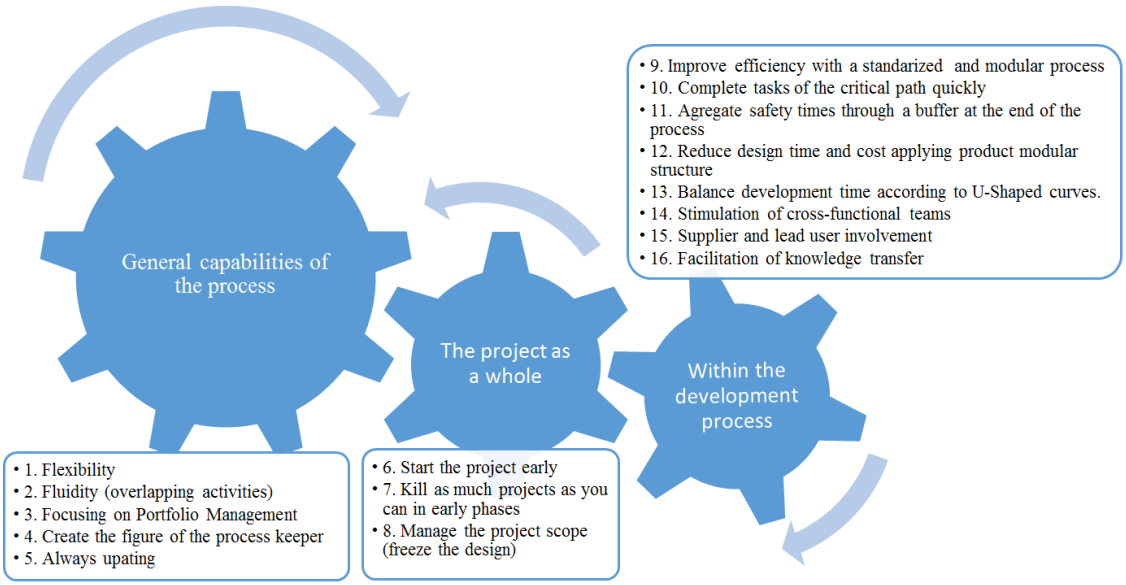


**Figure 5. Summary of the selected acceleration techniques of NPD**

All these techniques and methods make the NPD process stronger and better and, as a result, they do the same in the firm. It is clear that a company which drives a good NPD process has competitive advantage between their competitors. Among other things that company will improve its productivity through upgrades in the latest technology, will have a competitive position in the market with more market share, a stimulation of a creative and innovative environment, and more revenue growth. Regarding on the risk management perspective, driving a good NPD process will result in having less business risk with more defenses against their competitors, and more accuracy on forecasting the market response as it is easier to predict if the time to market is shorter. This last argument also evidences that accelerating this process also has a good effect on product quality as it, a part from having more accuracy on the market response, improves problem solving, and uses cutting edge technology to produce new products.(Lin et al. 2012; Krishnan & Ulrich 2001).

Moreover, we also have to be aware of the fact that not all the products have the same nature, Developing a material product for example is not the same as developing a service, driving a NPD process in a small company is not the same as driving this same process in a big one. That is why all these listed techniques are not valid in every new product development process of every company, or have more importance in ones than others. Therefore, a study has to be made in advance by every firm regarding on what their product needs for being well developed and which techniques are going to help that specific process and which are not. (Lin et al. 2012; Krishnan & Ulrich 2001).

Going further in that topic Langerak and Hultink (2008) consider that products should be distinguished by their degree of innovativeness. In their opinion this is the main factor that makes products go through different types of innovation processes. Several authors make reference to that fact: (McDonough 1993) say that *"Highly innovative new products are less certain, involve a greater proportion of experimentation and iterative problem solving, and hence require more flexibility and learning. Less innovative new products are more certain, involve a greater proportion of planning and implementation, and hence require more efficiency and compression"*, furthermore (Ledwith et al. 2006) said that *" Successful firms need to be able to manage*

*simultaneously for short term efficiency by emphasizing stability and control; as well as for long term innovation by taking risks and learning by doing"* . If this approach is studied deeper we can see that there are some products done in a short term that don't require the whole implementation of the NPD process so they can skip some steps or made them more concrete and faster. Sometimes this change is so big and the resulting process is so different that it cannot be longer called NPD. At that point, a new concept needs to be developed explaining the new process and defining the nature of the product that aims to develop. That approach opens the door to the next chapter that pretends to define one concept based in the already explained one but with some clear differences, Rapid Development (RaDe).

## 2.2 Rapid Development

### *2.2.1 The origin of the concept*

Throughout the business history the firms have been pressured to adapt to the continuously changing environment of the market and the competition. Organizations are trying to operate profitably in the actual environment of unpredictable changing customer opportunities, thus being as agile as possible. Nowadays, remaining competitive in the market also lies into doing moderated innovations on products that already exist in the company's portfolio, with short lead times and in varying volumes. In some particular cases the whole implementation of the New Product Development Process, even if it is done in an accelerated way, doesn't seem to be the most optimal method to produce these kinds of products. They can need to be done faster and with less depth study in some fields, as they mainly have lower level of uncertainty and less development effort. In fact, Cooper (2001) predicted a need to have a short-cut process with fewer milestones for lower-risk projects like product extensions, improvements or product renewals. This short-cut process creates by itself new concepts like Rapid Productization (RP) and Rapid Development (RaDe). Both are quicker implementations of the NPD process addressed to products that can be developed faster due to their especial nature.

According (Suominen 2009) Rapid Productization is "*a standardized process which aims to produce a high quality commercial good or service viable in the market from produced information"*. In a general framework, several articles refer to that concept as analyzing the needs of customers, designing the product and developing the ability to produce it (Harkonen et al. 2013). If we go deeper in that concept we will see that it is mainly applied for those products that need a minimum engineering effort because the new product is supported by an existing product platform, and hence mainly is all about creating and designing the product architecture. In fact, here lies the main difference between these two concepts and the reason why rapid development concept is created. RP is considered to be an activity that follows a research and development phase and purely aims to form a conception over the requested product in order to provide a solution to customers (Harkonen et al. 2013; Hänninen, Muhos, et al. 2013; Murray 1999; Van der Loos 1995). On the other hand, RaDe goes further and take position on the realization of the product, carrying out the development phase as it embraces projects with more complexity on that stage. In other words, in RaDe the RP process is carried out deeper in order to not only assure that the product can be done but also define how it is exactly going to be manufactured and delivered due to its complexity on that field.

At this point, is pretty clear that RaDe is not an acceleration of NPD; it is a partial application of its principle and methods, emphasizing some techniques with the aim to redesign or upgrade products quickly and inexpensively. The question now is: How can we detect these particular projects? If they are well detected, companies will save money and time in useless costs and activities that can be skipped, also improving their product quality delivering it faster. Here are presented some characteristics that can help the firm to find out at first sight if RaDe process can be applied: (Hänninen et al. 2013b).

- **The starting point of Rapid Development process is sales department** and not marketing, as the product is decided to be developed due to a **direct customer request**. This **lowers the degree of uncertainty**, as is less risky to develop a product whose customer is ensured.
- This new product is usually developed to fulfill a particular and individual customer need. Thus, it is **not necessarily going to appear in product portfolio**, because this may be an isolated request for only one customer and it may not fit with the strategy of the company.
- The required product is **supported by the existing product portfolio**. Thus, it is neither an invention nor a really high innovation but some development work has to be done. Understanding for invention a first occurrence of an idea, and for innovation an actualization of a past invention of the company or a combination of products that already exist in its portfolio. Therefore, the **development effort is not as high as in NPD process but not as low in RPP** where the engineering work is minimum. It can also have **more predictable delivery time than in NPD** as the production is easier and faster.

In conclusion a definition of Rapid Development can be deduced from the gathered information. Rapid Development consists in a standardized process which aims to produce a good or a service using information of products viable in the market and in the company's portfolio in order to satisfy as fast as possible a direct customer's request given by sales. This process is really fast, as it uses existing products of the company to develop the new one, thus not radical changes are made but a moderated development effort is done and has to be taken into consideration inside the process. At the end, the resulting product will be a high quality product in relation of the development cost. (Suominen 2009).

Moreover, another concept that is really close to RaDe has been detected and should be differentiated. They are the upgrades of products that don't need to be developed faster. They would be all the new versions of already existing products that, although they are easy to develop, they have to wait for a while until the customers' are ready for another version of the product. Actually, these projects (RP, RaDe, product upgrades) are becoming the vast majority of the product developments inside the industries, and hence it is really important to well detect them and have a good process to carry them out. After analyzing which are the main capabilities that define a Rapid Development's product now is time to know more about the project that is going to bring them into life.(Conway & Steward 2009)

### *2.2.2 The process*

As the functionality of Rapid Development is different than in New Product development (in this case an offer is made for specific customers instead of doing a market research of promising ideas) the process will have some differences. In the

general framework RaDe process is going to have fewer and easier things to do and hence less milestone gates than NPD, with more specific entry and exit criteria. In other words, this process will have less but more concrete questions to be answered to move on the next phase. This will make the process more fluid , thus enabling the firm to carry it out in a short term, as time is pressing, and especially in that kind of processes where a customer is waiting for a result. The standardization of the process is a key factor while developing these kinds of products as it allows managing and controlling it more efficiently, as well as being better prepared to unexpected issues. (Hänninen et al. 2014).The main phases are as follows.

### Stage 0: Process initiation

The first differential factor of Rapid Development is the way it is initiated, as it is done by a direct customer's request instead of a creative phase of new promising ideas driven by marketing department. This factor makes a great change at the beginning of the process compared with new product development. It also makes some rebound effects while developing it. Mainly, the process is initiated when a customer requests a product that doesn't fit with the predefined offering of the firm but is mainly supported by the company's product portfolio. In other words, a customer asks some new requirements for one existing product of the company. This stage is driven by sales department, as it is the one who makes direct contact with the customer, and cannot last long and cannot include a large number of stakeholders (Hänninen et al. 2013b; Kinnunen et al. 2013). Summarizing, this stage is not about coming up with a disruptive idea by studying and assessing target market needs, is about detecting business opportunities inside a customer's request and put them in a concept funnel in order to detect which ones are the most attractive for the company.

### Gate 1: Idea potential

**Is the idea promising?**
**Is there the necessary support from the company's portfolio?**
If there is no support it will be a NPD case and will have to be studied deeper according to the Stage-Gate process because, without existing platforms, it is not going to be rapid development. (Hänninen et al. 2013b)

### Stage 1: Analysis

As driving this process means spending a lot of resources the firm has to choose which projects to run first or which projects are most valuable for them. Therefore, at this point when a potential business opportunity is detected and is supported by the firm's portfolio, is time to begin to analyze the business opportunity deeper in order to assess the viability of the idea, and to understand with detail what the customer wants, what is needed to be done to deliver the product and if it is possible to make it happen thus narrowing the projects' funnel. That stage is mainly focused on the part of the business case related to understand and analyze the customer's requirements as fast and as good as possible. Sometimes this can be quite challenging as the potential customers have difficulties on articulating their needs. The main task during this phase is to **recognize the customer's value and demand** by defining and justifying the product and the project, determining the supporting platforms and the available resources, and **ensuring the needed technology**. Unlike NPD, RaDe's business analysis is not going to be extremely detailed, as the investment is less than NPD, thus it is not going to pay so much attention on the market assessment (only a quick customer's value assessment is done) also because the process doesn't have uncertainty regarding to the potential

market. This stage is driven by sales but, as the viability of the project is assessed, a cooperation with R&D is needed, as the discussions are concerning both departments, sales knows what the customers want and R&D is the responsible to decide if it can be delivered. So a good coordination and knowledge transfer is essential to make the process easy and fast. (Hänninen et al. 2013b; Kinnunen et al. 2013; Suominen 2009)

Gate2: Go to planning the offer

**Are the customer's requirements met?**
**Is the technology feasible to make?**

(Hänninen et al. 2013b; Kinnunen et al. 2013)

Stage 2: Rapid offering

At the beginning of that stage the company should have understood and met all the customer's requirements and the work should only consist in finishing the business case analysis. At this stage **the project is planned and scheduled on detail**, roadmaps are done, the delivery time is determined, the available resources are allocated and hence the delivery capability is decided in order to not compromise the ongoing projects and production (whether to use a third party component, use only their own implementation or a combination of both). A special attention must be made in that last issue as the resources availability constitute a serious bottleneck in the process and management team has to decide carefully whether to use third party vendor or not, who is going to be and what will be their involvement on the project. Furthermore, a normal risk study should be made concerning to **financial assessments** and calculations (Pay back, net profit…) to support the decision to invest in the project. It is important to emphasize that the project plan is a key task in that stage as these types of projects require moderated engineering work and also a good plan and good techniques for carrying them out. (Hänninen et al. 2013b; Kinnunen et al. 2013).

Finally, it should also be decided another factor that is not present in NPD process, if the case will be only for a single customer or if it will be part of the general portfolio offering. If the management team **decides to include that product on the portfolio** they have to be more strict if it fits on the company's strategy or not. (Hänninen et al. 2013b; Kinnunen et al. 2013)

When all the decisions are made is time to make the offer to the customer. This stage also requires an intense collaboration between sales with R&D department in order to decide all the operational and tactical issues of the process.(Hänninen et al. 2013b; Kinnunen et al. 2013).

Gate3: Offer acceptance + Go to development (Hänninen et al. 2013b)

Strategic decision: **Is the product going to be present in the company's portfolio?**
Tactical decision: **Is the project plan feasible to make in a certain amount of time?**
External decision: **Does the customer accept the offer?**

→ YES → Go to stage 3
→ NO → Cancel the project and storage data

Stage3: Product development and testing

With all the capabilities ensured and the project accepted by the customer is time to develop the product. This means to **implement the project plan** designed on the last stage in order to **develop** the new features, **produce the prototype** of the new product

and **test** it. It should be emphasized that time is pressing and customer is waiting, so the process goes through a countdown. Therefore, all the unnecessary steps have to be skipped and the process has to be accelerated as much as possible.(Hänninen et al. 2013b)

Concerning to the knowledge transfer, this stage constitutes a critical point because unlike the other stages this one is driven by R&D and hence all the responsibility is transferred to it from sales. This means transferring all the data acquired in the last stages and requires a lot of attention to not miss any important information during the exchange as well as not wasting time on processing useless information. The most important factor to successfully transfer responsibilities is to define the ownership of the product of every stage of their production, in order to know where all the information is located. (Hänninen et al. 2013b)

Stage 4: Product delivery

When the product is finished, it is delivered to the customer. Therefore, there is no need to do a launch process like NPD process unless the product is decided to be included on the company's product portfolio. In that case a little launch of the product I must be done in order to promote it to other interested customers. (Hänninen et al. 2013b)

Auxiliar stage: Post launch review

The post-delivery review is also interesting to be done as it gives information about the customer's satisfaction and hence helps the firm to control if their RaDe process is well designed and executed. It is important to know which the customer's feedback of the product is in order to detect possible problems and weaknesses of the process. This is easier to assess in RaDe than in NPD because here the customer is defined whereas in NPD the company is dealing with an entire target market. The sales department making contact with the customer drives the task. (Hänninen et al. 2013b)

After studying this process it is clear that, besides the distinct nature of the products, there is a difference of fluidity between New Product Development process and Rapid Development process. This last one contains more concrete tasks controlled by more fine-tuned gates that allow a faster development. However, it has been also detected that Sales and R&D department have a huge interdependence while developing the tasks and hence makes RaDe process more challenging in the coordination and management of the teams. It is for that reason that RaDe process needs to spend a high number of resources, especially the human ones, as this process needs to be carried out by the best personnel of the firm. These people constitute a little group within the company and need to be accurately allocated in the right projects. Therefore, we can say that this fact limits RaDe projects performance because if there are not people to carry it out there is no project to develop, even if it is potential and viable. Regarding on the project management effect on that challenge it has been seen that if the roles of each department are clear, the process is going to gain a lot of speed and agility. Therefore, in order to clarify the tasks' ownership, a diagram is presented in Figure 6 with the main activities of the process with their respective executor. (Hänninen et al. 2013b)

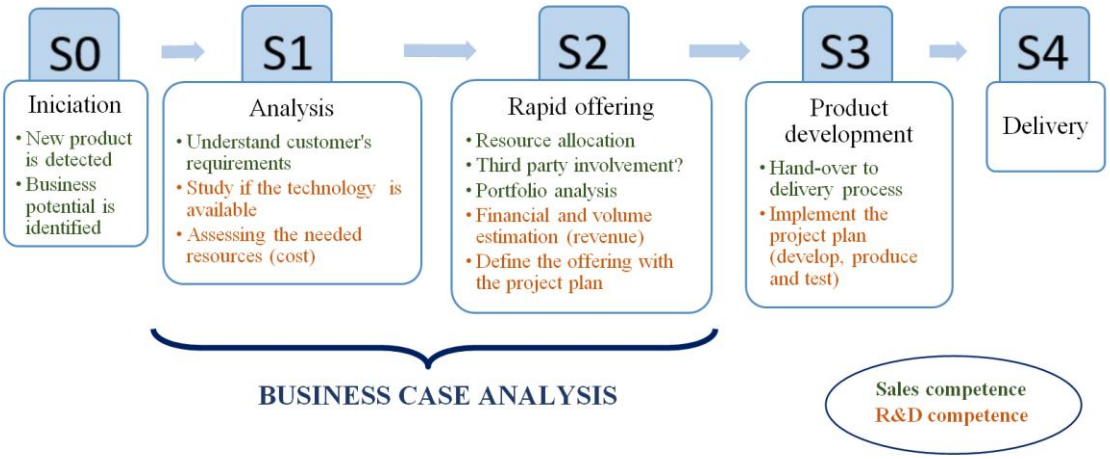


**Figure 6. Summary of the main activities of RaDe process**

### *2.2.3 The challenging part: Product data management*

Product data management is seen by (Hänninen et al. 2013a) as a challenging issue when performing a RaDe process. As (Kangas et al. 2013) said; product data is no complex in nature, the challenge is to define which is the needed data and rapidly provide it to the team that needs it. It is for that reason this issue is going to be studied further in order to better understand its complexity in the ways it can overcome the problems. This concept involves three main essential tasks for the good knowledge management. Knowledge creation (data collection, combination or refinement), knowledge administration (data storage) and knowledge transfer (data dissemination within and outside the project).(Suominen 2009).In other words, product data management is all about knowing what information to gather, where to put it, and to whom and when to transfer it. All these three aspects are important and challenging in these situations where time is pressing and all has to be perfectly performed.

**Knowledge creation:** Communication

This activity is mainly referred to two important tasks inside the process: the way sales people communicate with the customer, and the way sales and R&D department can find and gather the needed information to develop a certain product.

In regards of the first subject, sales department has to know what to say to the customer and how to say it, understanding what they need and detecting the business potential of the idea. To accomplish that task sales team have to work close with R&D department that is going to inform them about the technical issues and, as the project is initiated by customers' requests, they must also be involved in the process appealing to them when decisions referring to the product architecture are made. Therefore, the key factor when creating knowledge is clearly the communication between these three groups listed above, thus managers need to have some especial skills, the hard ones and the soft ones. Hard skills are the ones referred to the tangible and technical knowledge; ergo the ones which let to know an overall view of the product itself, the cost structure and what will be the delivery time. These are key questions during the negotiation with the customer, if sales don't give an exact answer they will have serious difficulties on selling the product. On the other hand, knowing how to share these hard skills within the team members and with the customer is essential and hence soft skills are needed. These ones help to build relationships, minimize the conflicts and understand each other better. In

fact, these skills are necessary in every stage of the process but are especially important in the situation when the customer is articulating their demand and needs to be perfectly sure that the company is going to deliver what he or she wants in a successful way. (Rao 2013)

Referring to the second task, the way the needed information to develop the product is found and gathered, is extremely important to find which already existing platform supports the new product and find all the related data. This often becomes a tricky task due to the high number of product variants present in the portfolio. This issue opens the door to the second concept of data management, the knowledge administration. (Hänninen et al. 2013b)

**Knowledge administration:** Modularity

In order to find easily the needed information, especially the existing components and resources that can help the project, it is necessary to have them stored in a clear way that helps people to find them. The best way to do that is by using a modular structure for both product and process architecture. Decomposing the product into independent subassemblies known as product modules creates the product modularity. They have so high degree of independence that allows the company to design and develop different products by simply combining these modules in different ways, and also makes easier to add new features on them. Therefore, having this capability is vital for Rapid Development projects as it is based mainly on that, doing little modifications on existing products of the company in short time. Accordingly, if the knowledge acquired in the last developments is administrated in a modular way it will be easier and faster to find which module supports the actually requested product, thus shortening its development's cycle time and product performance. (Danese & Filippini 2013; Jacobs et al. 2011; Hänninen et al. 2013)

In regards of process modularity, this also helps both data administration and product performance, as it is based in reconfigurable infrastructure and teams that perform independent tasks in parallel. Nevertheless, the firm have to be careful while setting up a modular structure as the excessive fragmentation of the product and the process sometimes makes the data management challenging as it is not as clear as it could be, and it can entail high production costs in case of over sizing modules and components. Furthermore, while setting up a modular process a perfect coordination of the teams is required as well as an accurate allocation of resources. But at the end of the day all will be worth because well applying both product and process modularity will increase the manufacturing agility and optimize the use of resources, ending on a company's growth performance.(Danese & Filippini 2013; Jacobs et al. 2011; Hänninen et al. 2013)

Applying modularity for administrating the acquired knowledge is also very useful when transferring information between departments and with external sources, having also positive effects on that. This leads to the next point of how this transfer can be done in the most efficient way. (Danese & Filippini 2013; Jacobs et al. 2011; Hänninen et al. 2013)

**Knowledge transfer:** With suppliers and between departments

When carrying out a RaDe project, there will come a time when the management team will see the gap between the customer needs and the existing portfolio. In that point a decision has to be made on whether to develop the missing parts in-house or whether to order it to a third party vendor totally or partially. In that point the knowledge has to be

transferred inside the company and/or outside it by means of the called critical data. When the project is realized as bundling third party, the critical data is the one describing the requested item and the quality by which this is transferred to the supplier. If on the other hand the project is realized in house the critical data must be the development costs and the technical impact of the embedded module. (Kangas et.al 2013).

Several authors emphasize that modularization can positively affect to the supplier involvement (Danese & Filippini 2013). When products are separated in modules it is easier to delegate tasks to suppliers as the producer can usually delegate the production of an entire module to them and even involve them into the concept development. Thus, it is easier to delegate a certain module to the supplier having more expertise on the needed technology resulting on a better and more effective product performance. However, when a company has a stable core product with a long lifetime, all modifications involving suppliers have to be carefully justified and require a detailed study and reasoning on who are going to be, why are they needed and what will be their role on the project. This decision embraces uncertainties such as the reliability of the supplier, giving them the appropriate involvement on the project or sharing the same interests. Therefore, this is a decision that involves a risk on the ability to respond quickly to the requests with proven delivery capability and product quality and has to be analyzed carefully beforehand. (Hänninen et al. 2013)

But, what will be the most optimal way to transfer the knowledge inside or outside the company? The most common way could be face to face meetings but some recent studies say that applying virtual communication can improve the speed of the project. Nevertheless, the team members have to be aware of the fact that this kind of communication requires some special skills (both technical and communication capabilities) and is challenging especially in the tacit knowledge transfer. This way of communication is quite new and has been gaining importance over the last years especially in companies that are dispersed in different countries. Therefore, it is an interesting point to study while talking about both processes.

## 2.3 Comparison between Speeding-Up NPD and RaDe

At this point of the project both processes have been defined, together with the main challenges and critical parts of each of them. Along this literature review these concepts have been compared and some differences have been detected. They are going to be summarized so as to see the main determinant factors while comparing these two concepts, thus answering RQ1. They can be divided into two groups; the ones of how to detect the type of project, and the ones of how to operate the project within the process.

### *2.3.1 Factors on how to detect the type of project*

| FACTOR | NPD | RaDe |
|---|---|---|
| **Starting point** | Started by<br>- Marketing department that detects an unmet need inside the market<br>- Sales department detects a customer request that is not supported by the actual portfolio. | Started by a direct customer request, single or multiple, originated in sales department. |
| **Leader departments** | Marketing department:<br>Detects and study the potential product.<br>R&D department:<br>Develop the needed technology and product architecture, as it has a high degree of originality and requires putting high effort on it. | Sales department: Communicates with the customer and understands what they want<br>R&D department:<br>Studies the technical part of the development that, although is not as important as in NPD process, it requires to put attention on it. |
| **Degree of innovation /Engineering effort** | NPD projects usually part from the scratch and build a complete new product, they make radical innovations and high platform innovations. It looks for disruptive ideas with a high degree of innovativeness and tries to sell them into the market. Therefore, this process carries out projects with high degree of innovation and hence doesn't count with a lot of support of the existing products in the company's portfolio and need a lot of engineering effort. | It consists on doing some moderated modifications of existing products of the company, and thus they don't have a high degree of innovativeness and require a moderated engineering effort, they do incremental innovations and little platform innovations. We can call this effort as moderated because RaDe not only makes a new configuration on existing technical items but also changes the technical structure in some way. |
| **Delivery time** | Delivery date is more difficult to predict and the project is long term planned as NPD projects have more complexity inside. | Delivery time is easier to be predicted and ensured to be delivered in a short term. The company is directly dealing with a customer that is waiting for the product and wants to know when it is going to be ready. Moreover, as it entails less complexity in the development it can be done in a predicable period of time. |
| **Needed Resources** | Needs more resources in general. Especially technical resources such as the test lab. | Needs fewer resources in general. However, it needs important human resources as it demands the most talented individuals of the firm that, after few projects, need to rest because they have high pressure. |

| FACTORS | NP | RaDe |
|---|---|---|
| **Degree of uncertainty** | - Market uncertainty: Not having a clear customer requesting your product.<br>- Uncertainty of the availability of the needed technology.<br>- Development problems due to starting a project from the sratch. It has a high degree of technological innovativenes that the company has to find and is not used to implement.<br>- Uncertainty on the amount of investment needed to run the project.<br>- Uncertainty on the delivery time, as it has been seen before. | - The difficulty to understand the need and the requirements of the potential customer.<br>- The uncertainties on how to detect and modify certain existing platform into a viable product.<br>- The uncertainty that supplier involvement can cause in the project. This is also present in NPD but has to be emphasized here as there is a customer waiting so the product has to be performed as fast as possible. |

### *2.3.2 Factors on how to operate the project within the process*

<table>
<tr><th>FACTORS</th><th>NP</th><th>RaDe</th></tr>
<tr><td>Degree of Standardization and planning of the process</td><td colspan="2">It has been detected that standardizing the project is important in both processes in order to have a common pattern to follow while developing new products with the needed tasks and the owners of them. This improves the efficiency within the process as everyone knows what to do and when to do it, thus it entails having less margin of error and less unexpected problems.</td></tr>
<tr><td>The process</td><td colspan="2">The base of the process is the same between NPD and RaDe as it consists in a series of stages controlled by gates that act as milestones. The main differences are found at the beginning and at the end of the process, as the starting point is different and there is no launch in RaDe.<br>▪ RaDe process<br> 

<br>▪ NPD process<br> 
</td></tr>
<tr><td>The stages</td><td>Entails the whole implementation of the stages.</td><td>Simplified implementation of it with less and shorter tasks.</td></tr>
<tr><td rowspan="2">The gates</td><td colspan="2">When the process is started the uncertainties are high, how the product is going to be designed, which technology is going to be applied…etc. The way to reduce these is by analyzing, making assessments and finally making decisions and hence shaping the project. Therefore, we can see these final decisions or gates as a mean to reduce the degree of risk of the development's process.</td></tr>
<tr><td>Needs to implement the whole milestone framework (it has more and stronger uncertainties).</td><td>Implements a fast track decision making framework with less and more concrete questions to answer.</td></tr>
</table>

| FACTORS | NP | RaDe |
|---|---|---|
| **Business Case analysis** | This analysis constitutes the task right before the huge investment is made, thus it is a critical activity in both processes and is where all the business uncertainties have to be eliminated. | |
| | - Idea potential<br>- Market assessment<br>- Technological assessment<br>- Financial analysis | Fewer subjects to study with less depth as the risks are lower.<br>- Idea potential<br>- Technological assessment (with less depth)<br>- Financial analysis |
| **Portfolio Management** | In the company the product portfolio management embraces both NPD projects and RaDe projects. Therefore, it <u>is an important phase in both</u> of them because is where is going to be decided which products are going to be developed and with which resources, so the procedure is the same in both cases. | |
| | They must <u>fit in the firm's strategy.</u> Therefore, a deeper study is made as the products will be automatically part of the company's product portfolio. | <u>Strategy fit is not necessary in most of the cases.</u> They are usually the result of a customer request whose products don't use to appear on the portfolio. |
| **Data Management** | - Apply clear and open communication.<br>- Application of modular structure<br>- Apply virtual techniques to improve the speed | - Apply clear and open communication with more importance as the process has to be faster.<br>- Apply modular structure with more emphasis as it simplifies a lot the search of supporting platforms.<br>- Communication with supplier and with customer is more important. |
| **Team coordination** | - Important. Positive results | - Important. Positive results.<br>- More difficult to manage as it has to be performed faster. |

# 3 Research method

After studying the literature and having found factors that define and distinguish both processes now is time to see how companies detect and carry out the process. To do that, 4 companies were interviewed and studied using a holistic research strategy (Saunders et al. 2003; Yin 2003) carried out by using an inductive approach. The research process was divided according to (Hänninen et al. 2014) into three phases: Case study design (interview model), single-case data collection and analysis, and cross-case analysis of results.

Having gathered and understood all the information found in the literature, the interview was designed first in order to not miss any important information when questioning the interviewees. The **interview model** was organized in 4 groups of questions: some company background, the NPD practice, the RaDe projects, and finally some questions comparing both concepts. This model is attached in Appendix A. Subsequently, little research on the companies was made. So to find **background information** that helped to see an overall picture of the companies, looking on their web pages and gathering information of past interviews and case studies was done. After that first data collection **face to face and phone interviews** were conducted to four company top management representatives in order to see how they understand New Product Development and Rapid Development concepts; how they separate the different projects between them two, and how carry them out. At the beginning of the interview a brief explanation about the meaning of RaDe and NPD was given to the interviewees in order to be sure they understand the terminology. These interviews were conducted in a qualitative manner making open questions in order to allow the interviewees explain and develop the topic. They were also recorded and transcribed to enable a deeper analysis afterwards. After this research process the sufficient in-depth understanding on the field was gained so as to **discuss the findings** and make a general approach by **mixing all the single analyses** and make a **final conclusion**. A summary of the implemented research method is presented in Figure 7.

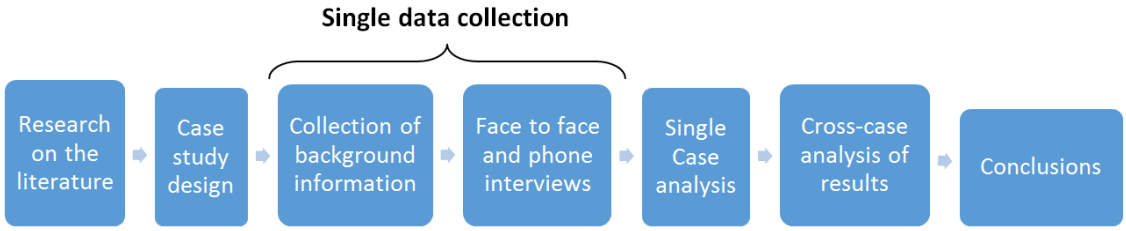


**Figure 7. Implemented research method**

# 4 Single data collection and analysis

The four studied companies come from different sectors of the industry and provide both products and services. They also have a strong goal to continuously innovate and update their products in order to remain competitive. Therefore, they apply new and different product development techniques that vary depending on their strategy and conceptualization of what they consider NPD and RaDe processes.

## 4.1 Company A

**Company A** is an AC drive manufacturing company located in Finland. It is in a leading position in the production of these drivers, having manufacturing facilities in Europe, Asia and North America. It can be considered as a technology oriented company where the development of the products is really dependent on the technology needed to develop them, specifically in areas of power semiconductors or software capabilities and communication technology. Its core activity is developing, manufacturing and selling frequency converters and components for industries to be used together with electrical motors and also to interface renewable energy sources like windmills, turbines and solar panels. Basically they have one base product (the AC drive) with a lot of variants that can be from a little device to a 5MW device. As the product's lifecycle is really large (around 20 years) the product goes accompanied with optional services: training, engineering solutions, installation maintenance and decommission activities, and upgrades.

They have their **portfolio** structured according to their performance requirements beginning with the basic division of compact devices (the smallest, easiest and cheapest ones), having then the standard division and finally the premium division with the products of the highest performance capabilities. Inside these categories they have their products split in powers and their product families separated in different generations of the product with optional accessories. One important thing to mention is that this company pays especial attention on making the portfolio as modular as possible. They have as a key task trying to make independent modules with their own specific requirements that can be developed separately so as to facilitate their manufacture and their outsourcing if needed.

Regarding on the **NPD process** they have plenty of ongoing projects, carrying out around 20 projects per year globally. The time line is between 1.5 years if there is based on an existing platform, and 3 years if it is started from the scratch. They have a pretty well standardized stage gate process really similar to the Cooper's one studied on the literature review; with a pre-study phase, a concept phase, a design phase, a pilot's trial release where the product is tested, a market launch and finally a post launch review

where the documentation is finished and stored, all together with the constant tracing of the business case.

The **main challenges** they have found while developing **the NPD process** are basically related to data management and product structure. Data management is seen as a difficulty in this company; making sure that all the requirements of the product have been identified, validated and documented for ensuring the quality of the product, its maintenance, and for using this information for future similar projects is seen as a critical point of the process. They also find the product structure challenging on terms of the design of a modular portfolio, they are finding serious difficulties on being capable of gathering the accurate requirements so as to outsource some parts of the product thus saving time and costs. At the end, the main challenge for them is how to optimize the product structure to provide the desired product with the right specifications to be cost effective but ensuring quality at the same time. They also think that the best way to overcome the majority of their challenges is to manage the people right, thus applying a good leadership on teams, as it is quite easy to design a project plan but not so easy to manage the people to make it work. Furthermore, other challenging issues to take into account are the portfolio management and the project management activities. They find these two subjects difficult to manage as they have a lot of ongoing projects where to allocate the limited resources and a lot of parallel activities to coordinate inside them. The interviewee added that the main way to overcome those is to apply software methods to be as agile as possible and hence accelerating the project.

When the interviewee was asked for the **acceleration techniques** the company applies into the NPD process he make emphasis that they are really careful on the quality assurance issue and so they are never going to take the risk to accelerate the process if the quality may be compromised. Therefore, they are pretty reluctant into applying any technique that accelerates the operational part of the process like reducing time and costs on the stages by for example overlapping activities. They mainly focus their attention on trying to coordinate the teams as good as possible in order to make the decisions more efficiently reducing time and costs in the gates. So their key point for them while accelerating the NPD process is to try to make a solid decision fast. Furthermore, the interviewee doesn't seem to differentiate the application of these acceleration techniques with the application of the rapid development process as he also mentioned them as the way to drive a rapid development.

When talking about the **Rapid Development concept** it has been perceived that the company sees the degree of innovation as the main key factor to decide whether to apply a fast track process or whether to apply the normal NPD. In their particular case the main way to make a fast track process is by providing a product where the change is only restricted to software configuration and it has around 6 months of duration. So basically the first task they do while having the product concept is to analyze if it is possible to develop the product with the existing modules of the portfolio, by only assembling them and doing little variations without modifying the hardware configuration. Therefore, the modularity plays again a really important role and is seen by the interviewee as a critical issue, as looking for existing platforms where to develop the new product is going to be easier and faster when the portfolio is modular. Furthermore, the starting point is also a determinant factor as they detect that these projects are started by a customer request, and so they have to fulfill the need in a short term. The customer relationship with the company is also a driver by which they decide to apply a fast track process. The value of the customer could be either high profits or

existing long-term partnership, so if the customer is a key customer their demands are going to be attended more accurately.

In regards of the **Rapid Development process** it has been seen that the company has not defined a separate and standardized fast track process. The interviewee was questioning if they needed one, as they don't want to compromise the quality of the product by skipping steps or making them shorter. Therefore, the interviewee is very reluctant to accelerate NPD processes and also to make a fast track process as he thinks that the quality and the robustness of the product can be compromised. They basically look at every particular case, and study which are the requirements and which are the critical verifications they need to make and which ones are not necessary. Following this line, they don't think that including the product on their portfolio depends whether this is done with NPD or RaDe as they always include all the products they have done and they are not interested in this kind of one time product, thus they study the strategy fit deeply in all the cases. The main detected challenges in Rapid Development processes are the resource allocation on every project and the risk management, considering the main focus of risk the communication with the customer, understanding their requirements and making them understand the product. It has been detected as evident difficulty that articulating the needs of the customer has caused many changes that increase the cost and delivery time.

**Joining these two concepts** it has been detected that the company applies a good NPD process with good acceleration techniques mainly focused in the decision making task, with a good focus in their portfolio and emphasizing the importance of good team coordination and communication to make knowledge transfer easier. However, the company doesn't have a clear and standardized differentiation of treatment between speeding up a NPD process and applying a RaDe process. They seem to differentiate these projects and detect different limitations and different critical points in each of them but not until the point of having the necessity to separate both, and they are also afraid of compromising the product's quality. Furthermore, they have found that applying a modular structure is equally important on both NPD and RaDe processes and constitutes a key activity on the company. Managing cross-functional teams also has the same difficulty in both processes for them. In regards of the supplier involvement and third party vendors, they have active relationship with them only in NPD practice as for them is difficult to provide the needed specifications to outsource certain part fast and hence it is not an optimal practice when trying to develop a product when time is pressing.

## 4.2 Company B

**Company B** is a sport's electronic instruments manufacturer founded in Finland that delivers both devices and services for people and companies that are requiring fitness and performance improvements. It counts with subsidiaries delivering their products to more than 80 countries. The products and services they produce are based on what the customer needs and wants so they consider them as a customer oriented company. Primarily they are making training computers and heart rate sensors for both end consumer business and for B to B sector like educational institutions. They are also providing fitness clubs with fitness equipment together with training solutions. Finally they also have an OEM division that sells components that fit in other companies' devices. Services are usually present as smart coaching services integrated in their devices or in smart phones and web based applications.

They have their **portfolio** structured in a modular way separating their products according to their three customer's segments (end consumer sector, B to B sector and OEM division). One important thing to mention is that the modularity doesn't reach the architectural level. They think that the more fractured is the system the more difficult is it to keep it updated and robust so they don't treat software and hardware as independent modules, they join them from the beginning acquiring a seamless interaction between them.

Regarding the **NPD process** it has been detected that the company has a wide scope of projects with different complexity that can be from a simple accessory for a bike to a whole new platform started from the scratch. They start an average of 5 to 10 new projects every year, having 10 to 20 simultaneously ongoing projects. Their timeline interval is approximately from 1 to 2 years of duration, even longer if the platform is completely new. The process is quite similar to the studied on the literature with a concept development, concept definition, product development, testing, finalization, and propose lunch in a very macro level, always controlled by gates where the process is controlled and the business case is fulfilled. It looks like this company has a very well standardized process with really defined parts and ownerships inside.

The main **challenges** they face during NPD process are: Achieving more fluidity increasing the speed of the process as they always want to be faster; the availability of the needed technology to develop certain product, as these are usually really disruptive; and finally the relation between their products and the environment, concretely with the web service and mobile apps, as they actually have a huge interdependence when providing the services for the products. The company is trying to overcome these challenges mainly by planning the projects with all the challenges and focus of risk detected and understood so as to have the minimum unexpected problems. Furthermore, they are also increasing their flexibility by means of improving the good team coordination, providing the team enough understanding of the vision of the product and its requirements in order to react proactively when an unexpected change comes out. This last task depends mainly on the communication capabilities of the company that is especially important in that case where a big crew is working together mixing lots of dimensions and having so many moving things at the same time (hardware site, software site, user interaction, user interfaces). Therefore, the key tasks while coordinating the teams are using the maximum transparency of communication and sharing the right information with the right people.

When talking about **acceleration techniques** the interviewee mainly repeated the last measures of increasing fluidity and flexibility, applying good team coordination, and finally planning the project with all the responsibilities of every team listed. Furthermore, he also emphasized in starting the project as soon as possible, looking for the acquired information that could help them to build the product and make easier to develop it faster so they don't have to start everything from zero every time.

In regards of the **RaDe concept** it has been perceived that the company understands quite well the main factors that differentiate this one from the whole NPD practice. They consider the amount of innovation of the project as a key factor with which to apply a RaDe process or not. This process mainly embraces these projects with a little amount of development in both software and hardware configuration, and always with the help of a supporting platform. The interviewee also stated a difference on the main departments that carry out the process as the company applies different team members located in less and more concrete groups. They also recognize RaDe projects as the low

risk ones that have to be performed in a short term and that require fewer resources and so less people but usually with the higher competence level of the company. Nevertheless there is a difference of conceptualization in one factor; this company considers that the starting point could be either a direct customer request given by sales or a fast update of a certain product given by marketing department. The main reason is that this department sometimes detects some product problems or new needs into the market that must be fulfilled in a short term and hence they have to be performed fast. This difference is quite well justified by their particular situation and is considered as a good way to solve these market unexpected situations provided that the project also meets the other requirements to be included in these type of fast track process. Finally the interviewee detected the business opportunity of the idea as the main driver to carry out the process. It is all about understanding the marketplace well and also predicting the needs of the end customer. They could be either Business to Business sector or the end customers by themselves.

As it has been detected before, this company seems to have a pretty well defined **RaDe process** differentiated from the NPD process. In fact, the interviewee talked about a special process for only delivering special make up products that are personalized and updated for different customers globally, especially the retailers that may need a certain product for example in different color for a specific date like mother's day. Its timeline usually goes from 3 to 5 months. One of the main **challenges** that this company has to deal with in these kinds of processes is again ensuring a good knowledge transfer within the team so they understand the target of the project. Furthermore, they have detected some other difficult tasks such as the good alignment and coordination between R&D and sales or marketing department to administrate the product's requirements. Production and logistics are also seen as a bottleneck as there are big material orders that have to be fulfilled in a little amount of time. Finally the product portfolio management is also difficult, as knowing where to allocate the resources and finding the right balance between low and high-risk projects seems to be a challenging task for them. Furthermore, the key activities they carry out in order to improve the project's performance is basically using existing information to save time and lowering the risks by mapping the project, detecting the critical uncertainties and going directly there skipping the places with no uncertainty and hence saving money and time. In regards of the strategy alignment of these kinds of projects the interviewee stated that the company hardly ever carries out projects for only one customer and so the strategy must be studied as deep as in NPD.

**Joining these two concepts** it is pretty clear that this company knows how to differentiate RaDe projects from NPD projects, thus it has a clear conceptual framework of them. Moreover, the company tries to find a balance on their portfolio by carrying out a mix of tactical projects (RaDe) and more strategic long-term projects (NPD) that apply different standardized processes. Therefore, they have different challenges and bottlenecks although all seem to be related with acquiring more flexibility and fluidity by planning the project but allowing a degree of freedom to let the people be proactive, and also by transferring the knowledge as good as possible. In regards of supplier involvement they use to have relationships with them in both processes with different degree of involvement. In case of NPD the interviewee recognized that it was more difficult to outsource as the company is developing new components with less familiar requirements. He also emphasized in the importance of having a clear picture of what they want so as to inform the supplier with the maximum accuracy and as soon as possible to ensure the punctual delivery. In case of RaDe, the interviewee stated that

outsourcing some components has positive effects in product performance and thinks that the main key factor is to have a list of preselected reliable suppliers who know very well the company and the products so as to save time selecting new ones and reduce the degree of risk of the process. The coordination of cross functional teams and applying a modular structure seem to have more importance in RaDe as it has the time constraint that requires fluidity on the teamwork as well as saving time by basing the new product on existing ones. Finally, virtual communication is seen as an important factor while enabling a better and optimized product performance but is not seen as a real challenge in any of the processes as the company has the core team of new product development located in the same place.

## 4.3 Company C

**Company C** is a mining machinery manufacturing company located in Finland. It can be considered as a global leader in mining machinery having manufacturing facilities in Finland, Sweden and Chile and being present in 24 countries around the globe. They consider themselves as a both technology and customer oriented company, with more emphasis in the customer orientation. They also have a wide range of product portfolio that includes both material products like mining machines, rock enforcement and construction chemicals; and life time care services like spare parts, installation, decommission and technical assistance.

They have a really big amount of products in their **portfolio** structured by a modular way. The different modules have a high degree of independency and can fit with different base platforms. The interviewee stated that the half of the portfolio was of mining equipment, 25-30% were services and the rest of construction chemicals.

In regards of **NPD process** they have a complete one that counts with 6 gates carefully controlled by steering committee. The 6 gates are: Viability study phase, implement evaluation, modeling and design, go proto manufacturing, serial production preparation, and final launch if the prototype is successful. In fact, the interviewee emphasized in the importance to control every decision by top management to have a close tracing of the process and not miss any step. In the company they have quite a big activity of projects every year, carrying out between 30 and 50 projects of which 10 to 15 are completely new products, the rest are improvements. The timeline interval for these complete new products could be between 1 to 2 years.

The main **challenges** the company is facing in their NPD process are related to the project management and to the knowledge transfer. They find project management a difficult task. The interviewee detected that keeping the process into the timeline is difficult as there are so many variations during the process mainly due to unexpected problems and the uncertainty of the supplier involvement, as they sometimes delay the deliver and make the company lose money and increase the development time. This project management is especially difficult when controlling the gates as the product is submitted to a selection with pretty specified criteria. The product has to perfectly accomplish the specifications to continue being developed as the company has a quite strict decision making approach. Concretely, the main critical gate of the process is recognized to be gate 3, go to development, as is right before the heavy investment. In regards of the knowledge transfer, they are finding difficult to have a unique en common platform were to unify all the data of the project and all the knowledge acquired in the past that could be useful for future projects. Communication is also related to that last issue and is recognized by the interviewee as a tricky task that has to be taken into account and improved every day. Virtual communication is seen as a good

practice to improve the project's performance but always being aware that data should be more unified and not leave it in the e-mails, phone calls other different virtual platforms.

When talking about **acceleration techniques** the interviewee stated that trying to communicate with suppliers more strongly so as to fix a delivery time with no delays is essential to accelerate their NPD process. Also reducing the time between proto production and manufacturing phases was seen by the interviewee as a feasible way to accelerate NPD process, as they are actually being carried out independently and have a slow interaction.

**RaDe concept** is well understood as the interviewee affirmed a necessity to have a especial and separate process for fast track projects so they don't disturb NPD ones and vice versa. The company has a pretty clear concept of what should be considered a rapid development project; the interviewee stated that almost the 90% of the new product is part of existing ones and they have a fixed delivery time that is between 12 and 15 months. However, there is a difference in the starting point factor, as this could be either by a direct customer request or an unexpected problem in one of their products that is not performing as well as it should be and has to be fixed rapidly. One thing to highlight is that this company recognizes that this process is different than the one in NPD as they are using the same sources but different people of different departments is in charge because they have different needs.

When talking about **RaDe process** and which is the main driver to carry it out, the interviewee affirmed, whether direct or potential customer, it is the customer value. The interviewee considered that in this process are no gates at all because when the request is accepted there are no more decisions, is just looking at the timeline and develop the product according to it. This is an interesting approach as gates are understood by the interviewee as the strategic business decisions. He affirmed that rapid projects are those that are handled in a lower level and that don't require the fully acceptance and control of top management; they are more tactical and less strategic. Therefore, the strategy is less studied as the main goal for them is to keep the customer happy and they sometimes develop a product that doesn't fit entirely with their strategy and develop things that are not their core business to maintain the good customer relationship. In fact the interviewee said that only a 5-10% of the RaDe projects are taking part of the final product portfolio. It was also said that for the company the most efficient way to ensure the project's performance while making the process faster is to apply protocols to control and reduce the unexpected problems as they consider this issue a critical one in their process. The main challenge of the process was again the knowledge transfer, especially the communication and reliability with suppliers so as to be able to keep the timeline and the budget. This issue has more importance in this process as it has to be performed faster and a customer is waiting so a little delay can cost lot of money on penalties. It is for that reason that they don't have a deep relation with suppliers in these kinds of processes as they see that it increases the risk. Therefore, they don't want to apply virtual techniques with them as they see that in this type of channel is more difficult to drive a strong and clear communication.

**Joining these two concepts** is pretty clear that this company knows the importance of applying an independent process for fast track projects to save costs and increase the quality and speed of the general product development practice (both NPD and RaDe). In fact, they have recognized the application of two different processes carried out by different people as they have different needs. Furthermore, in both cases the company is

focusing its attention on the project management and the communication and reliability with its suppliers, as they are the main two critical points for them. They also emphasize on the data unification as one of the main goals they are trying to achieve. Finally, it has been recognized by the interviewee that applying a modular structure and cross functional teams is more important in RaDe processes as they rely more in the product portfolio to develop their products and need better coordination to gain speed. It is also found that is more risky to involve suppliers in RaDe as the timeline is stricter and hence virtual communication is not applied in these cases, but is equally important to standardize both processes.

## 4.4 Company D

**Company D** is a telecommunication test and services' provider company located in Finland that has a global presence and helps mobile phone operators to improve their networks. It is a technology oriented company that aims to provide an efficient mobile network to their customers, the intelligence to maximize its value and the services to make it all work together. Accordingly, this company provides on the one hand the base stations, concretely the radio products that include both hardware and software. On the other hand, as the lifetime of these products is really long they have a really wide range of services of implementation, maintenance and updates. In addition, it has established quite many relationships with partners and they see it as a way to add value to their products. One thing to take into consideration before analyzing the case is that the two interviewees take part into the hardware development and they were less familiar with software development, so the analysis is going to be more focused into the development of the physical devices.

This company has big and broad **product portfolio** mainly structured in three parts: Hardware, software and services, with high interrelation between the two first ones as the company is selling the products together with the software updates so they have to be perfectly synchronized. Modularity is also recognized to be the structure of the portfolio and one important part of the company's DNA.

The **NPD process** seems to be really well developed in this company, especially the creation process of the most disruptive products with the latest technology. They approximately carry out between 40 and 50 ongoing projects every year but only 2 or 3 are submitted to a high degree of innovation manufacturing a whole new platform. The approximate timeline interval of these complete new products is from 2 to 3 years. The main process described by the interviewees in general terms has the main phases of cooper's stage gate process with concept creation, project planning with resource allocation and possible need of a third party vendor, planning execution, verifications, deployment and final review of the lessons learned for future projects as well as customer's feedback. The interviewees emphasized many times the importance of the market analysis, understanding perfectly the customer needs, and also of the concept creation task, defining the product and looking for the availability of the technologies and other resources required to develop it.

When asking about the **challenges** of their NPD projects the interviewees make emphasis again on the complexity to execute the two main tasks they pay more attention inside the process: The importance of defining and understanding the market needs, and the importance and difficulty of finding which are the needed resources to develop the product, what are the ones they already have, what are the ones that are missing mainly in terms of technology availability, and if they will be ready when the project requires

them. However, the interviewees affirmed that they don't have serious difficulties in the operational part of the process as they have a good process implemented and the resources are high quality. The important limitations come from the tactical level of decision-making and team coordination. These two concepts seem to be closely related to each other as team coordination seems to be the main enabler for good decision-making. Furthermore, the reason why team coordination is seen as challenging in this particular case is because the company has complex products that need different areas to coordinate between different teams of different competences and also geographically disperse regions. So the main **solution** for them is to make everybody understand what the core of the product is, and after that carefully plan the project with all the team roles and interactions defined and understood by everyone, using a completely clear and open communication. To enable the good project plan and team coordination the company is trying to split both product and process into pieces by creating sub processes for every module, thus applying a modular structure not only for the product architecture but also for the process. Finally, another task they are finding important to ensure a good process performance and an easy and fast decision-making path is to identify the possible critical points of each project and which would be the solutions if these happen, in order to reduce the unexpected problems and the uncertainty of the project as a consequence.

When talking about **acceleration techniques** the interviewees stated that they were trying to improve their operational process in many ways that allows them to allocate fewer resources into the development tasks. They consider the possibility to implement some acceleration techniques that could reduce a little bit the initial quality of the product, still being high enough for the initial product's performance, deliver it to the customer and make updates and improvements afterwards. In this particular case this measure is understandable as the lifecycle of the product is so large that they can afford these concessions and fix them later without compromising the good product's performance in the end.

**RaDe's concept** framework seems to have pretty clear factors that distinguish this concept from NPD and some others that are a little bit ambiguous. On the one hand this company is aware of the fact that there are some projects that can be done faster by modifying an already existing platform. The company applies a fast track process only when there is an urgent customer need that has to be fulfilled quickly and when the product requires a low engineering effort. The amount of time spent to develop them goes from 9 to 12 months. On the other hand, having limited amount of time is seen to be the main driver to carry out a fast track process but the timeframe for them is uncertain as the instructions use to be to deliver it as soon as possible. Furthermore, they don't understand RaDe process as a separate process yet and they apply the same NPD process but using smaller teams where the main responsibility could be different depending on the product needs. In addition, the degree of risk doesn't seem to be a defining factor of RaDe processes as they can be low risk projects but also high-risk projects if sales department make the decision to carry out a difficult project as soon as possible. In that situation there is always the risk to not being able to deliver the whole product in short term and deliver the minimum at that time and begin to do modifications later on. Furthermore, less resources are allocated in these kinds of projects but when asking if they required the allocation of the most competent people the interviewees stated that the best people for these projects is the most experienced and not the most competent as these last ones are usually more creative tending to not follow predefined steps, that is a crucial factor for the correct performance of these projects.

As it has been said before, this company doesn't have much of a standardized **RaDe process** so they recognize that the degree of risk is higher as it should be if there were clear steps to follow. The main detected challenges apparently seem to be similar than NPD: Decision making especially in terms of when to include a project into RaDe process, and team coordination emphasizing in the accurate coordination between departments and also with the customers. They affirm that the best way to overcome these challenges of communication is by having a cohesive team to work and having qualified people inside them. They are also taking measures to improve the speed of RaDe process while developing the basic product in NPD. When they are carrying out the original product they try to carefully look into the product architecture and make it scalable in order to fit well if a customer need requires that product or part of it in the future as its main platform. In other words, they are using the modularity to help them perform a possible future Rapid Development project faster.

**Joining these two concepts** we can conclude by saying that this company has a pretty good NPD process implemented with no problem in the operational part and is aware of the existence of two different types of processes. However, they don't have a standardized criteria with which decide if one process should be done using a fast track process or not. Therefore, they don't have a standardized fast track process although they recognize the necessity to have one. Moreover, the teams are usually more tailored in RaDe as they need the best skills there. In regards of using virtual communication to improve the knowledge transfer of the company, the interviewees affirmed it is a vital factor nowadays that they work in geographically disperse areas but is essential to have a face to face meeting before beginning with the virtual communication. They see that this practice is more used in NPD as the teams in RaDe use to be smaller and located in the same place so they don't need much of this kind of communication. Finally, supplier involvement is seen as essential in both processes, although it is seen as more critical in RaDe because of its short timeline. The company considers that having relationships with suppliers decrease the risk as these companies have more expertise in producing the needed component, and hence product performance will be more ensured at the end. However, as they are different companies there is less flexibility of communication and hence there is a barrier that has to be overcome mainly by well clarifying the requirements taking advantage of the product modularity.

# 5 Discussion: Cross-case analysis of results

Having analyzed the data acquired in the interviews now is time to see if there are some common activities and behaviors between them that can provide more understanding of how are they applying the processes and how are they differentiating them, thus answering RQ2. A table has been made with the outcomes of the interviews so as to have them more organized and make the analysis easier (Table 6).

***Table 6. Outcomes of the interviews***

| | COMPANY A | COMPANY B | COMPANY C | COMPANY D |
|---|---|---|---|---|
| **Background information** | AC Drives<br>(long life cycle)<br>Technology Oriented | Sports electronic instrument<br>(disruptive technology)<br>Customer Oriented | Mining Machinery<br>(long life cycle)<br>Customer oriented | Networks provider (Disruptive technology, long life cycle)<br>Technology oriented |
| **Portfolio** | Modular (key activity)<br>According to their performance | Modular<br>According to customer segments<br>Hardware-Software interrelated | Modular<br>According to their performance<br>High degree of independency | Modular (Key activity)<br>According to functionality<br>Hardware-Software interrelated |
| **NPD process** | 20 projects/year<br>Timeline 1.5 to 3 years | 10 to 20 projects/year<br>Timeline 1 to 2 years | 10-15 projects/year<br>Timeline 1 to 2 years | 2- 3 projects/year<br>Timeline 2 to 3 years |
| **Main goal** | ENSURING QUALITY | ACHIEVING MORE FLUIDITY | DELIVERING ON TIME | DELIVERING AS FAST AS POSSIBLE |
| **Challenges** | - Data management (defining the requirements)<br>- Ensuring product modularity | - Increase process speed<br>- Tech.& resource availability<br>- Relation product-network | - Project management(timeline)<br>- Knowledge transfer<br>- Suppliers' reliability | - Fast decision making<br>- Tech.& resource availability<br>- Team coordination |
| **Solutions** | - Manage people right<br>- Good resource allocation | - Well planning the project (reduce unexpected problems)<br>- Communicating the core product<br>- Flexibility (more team proactivity) | - Data unification (creating a common platform)<br>- Stronger communication with suppliers especially | - Well planning the project (reduce unexpected problems)<br>- Comunicating the core product<br>- Process and product modularity |
| **Acc. Techniques** | -Make solid decisions fast | - More flexibility and fluidity<br>-Starting the project early | - Make supplier deliver on time<br>- Decreasing design time | - Lowering the initial quality of the product |
| **RaDe concept (factors)** | Only Software changes<br>Timeline 6 months<br>-Direct customer request<br>-Low degree of innovation<br>-Less resources same process<br>DRIVER: Customer's value | Software + Hardware changes<br>Timeline 3 to 5 months<br>-Customer request/Urgent update<br>-Less risk and innovation<br>-Less resources different process<br>DRIVER: Business opportunity | Hardware changes<br>Timeline 12-15 months<br>-Customer req./Urgent update<br>-Less risk and innovation<br>-Less resources diff.process<br>DRIVER: Customer's value | Software + Hardware changes<br>Timeline(uncertain) 9 -12 months<br>- Direct customer request<br>- Less innovation, variable risk<br>-Less resources same process<br>DRIVER: Time (limited) |
| **RaDe process (challenges)** | Not fully diff.- Not standardized<br>Strategy fit: Fully studied<br>-Good resource allocation<br>-Communication with customers | Differentiated -Standardized<br>Strategy fit: Fully studied<br>-PPM (balance low/high risk proj.)<br>- Coord. Sales/Marketing-R&D<br>- Project management (plan) | Differentiated-Standardized<br>Strategy fit: Less studied (one time products)<br>- Communication with suppliers<br>-Project management (plan) | Not fully diff.-Not standardized<br>Strategy fit: Fully studied<br>- Standardized RaDe criteria<br>-Team coordination<br>- Scale product architecture |

**Comparing the output of the literature review with the data** acquired on the interviews there are some findings that have to be mentioned. The majority of the companies consider almost all the factors listed on the literature as the ones that differentiate and define both processes although in some cases they have different points of view. The **starting point** is seen as one of the factors that do not seem to follow a common pattern, as two of the four companies consider RaDe projects can also be started by marketing department besides a direct customer input. The difference on the **departments** that lead the process is also difficult to understand by the interviewees in the majority of the cases. Furthermore, all of them agree on the **lower uncertainty** that the projects should have to be included in RaDe process and they have specific focuses of risk depending on what they are producing and how are they prioritizing while developing it. At the same time the low degree of innovativeness, the fewer needed resources, and the shorter and more predictable delivery time seem to be a representative of RaDe process in all the studied cases.

In regards of the **factors needed to operate the projects** within the different processes, in general terms all the companies agree that are really close to each other. **Knowledge transfer**, coordination and communication between departments and with the customer, and **project management**, allocation the needed resources and detection of the uncertainties before beginning the project, are found to have more importance in RaDe projects as they have to be performed faster. **Team coordination** is seen as an important factor in both processes. Furthermore, although the teams are smaller in RaDe projects, they also have to perform really quickly. This fact explains why some companies consider that factor even more challenging in RaDe projects. **Virtual communication** is seen as a good tool to improve the project's performance but some companies are a little bit reluctant on applying them as the data is not as unified as it should be and is more difficult to communicate the right information with suppliers for example. Therefore, it can be deduced that this type of channel is used only when there is not a clear difficulty of communication between the two parts and when it is not in a critical part of the process. In these cases face to face communication is the best solution as it decreases the risk of misunderstandings. Furthermore, virtual communication in RaDe is seen as less used in general as the teams are little and work together in the same place. **Supplier involvement** is seen as a really useful tool to improve the speed of the process provided that the requirements are perfectly specified and the supplier is reliable. Finally, all the companies try to take **advantage of the modular structure** while outsourcing some modules. Some of them succeed on that task, some others like company A are finding difficulties to provide suppliers with the right requirements to develop the components, and there is also company C that has been struggling with the suppliers' reliability to deliver the products on time. Furthermore, the majority of all the companies find modular structure more useful in RaDe projects as these mainly depend on this list of existing modules to find the one they can use to build the new product.

After these findings detected now is possible to have an overview analysis of the whole information acquired on the interviews and on the literature.

Firstly, **NPD process** seems to be well standardized in all the companies, having a similar stage gate process than the Cooper's one mentioned on the literature. At least with the same important tasks established in the same order and degree of importance. In fact, Company B and D stated that the most critical part of the process is in the go to development gate where the Business Case has to be fulfilled and is the last decision before starting with the big investment of the product, factor that was found to be the

most critical also in the literature review. In fact, this makes even more sense when it is realized that these companies are the ones that are developing disruptive technologies. Therefore they have even more uncertainty on the technical assessment of the Business Case analysis as they are dealing with new technologies that may not be available when starting the project.

Depending on their **strategy** and on what products they manufacture, the companies have different critical points and prioritize different process capabilities. For example, company A and D have both products with a pretty long lifecycle but have different strategies and hence apply different techniques. Company A prioritize the quality assurance over the speed of the process whereas company D though that they can reduce the quality of the products and do some modifications later on if that means allocating less resources thus speeding the process. Another example could be that in companies B and C the starting point of a rapid development process could be either sales or marketing input whereas the others only consider a direct customer input. This last issue is due to their particular situation and their mindset of strong customer orientation that drives them to detect a problem on one of their products on the market and try to solve it as fast as possible even if there is not a particular customer waiting. This evidences a strong interrelation between the applied techniques, the market orientation and the type of products every company is selling.

Another thing that has been detected is that, in general terms, almost all the companies recognize that accelerating NPD process is not the same as developing RaDe one as the nature of the projects is different and hence requires different treatment. Two of the 4 interviewed companies (company B and C) have a good definition of **RaDe concept** and hence they have a more defined and standardized process. The other two have more ambiguous definition and differentiation that make difficult to build standardized criteria to drive a separate process. Therefore, we can deduce that the more degree of understanding of RaDe's concept the company has, the easier it is to build the needed criteria to differentiate both processes, and hence the more different is the treatment and the applied techniques between them.

Despite of that last finding it has been detected that there is still a long way to achieve the **accurate standardization of RaDe** process in all companies. Only company B seem to have a predefined process for certain releases of their products that are always done in a rapid way, with their predefined steps and pre studied list of suppliers, but there is more work to do to define exactly which common steps to follow. Company C has also a different process for fast track projects but has some important uncertainties. While communicating with suppliers, planning the project to increase the delivery timeline does not make the process as rapid as it should be.

**A last finding** that has been made during the analysis is more a speculation than a bold statement, it could be interesting to study further and so it should be mentioned. It has been detected that the companies that have included the urgent updates in the rapid development process are the ones who have better implemented criteria of that concept. So, it could be deduced that the companies that have based RaDe process on a more strategic approach have studied it deeper and hence have a better-defined rapid development process. However, as said before, this is a mere tendency that cannot be considered a rule now as the sample where the data is extracted is quite small.

# 6 Conclusion

## 6.1 Concluding remarks

After all the work analyzing the data on the literature it was detected that the main way to differentiate RaDe process of NPD is to look on which are the factors that set up the process and which are the ones that define how to carry out the project within the process.

Then, when making the interviews and analyzing them, this topic became more complex and less clear as every company has its interests and applies different techniques as a consequence. When analyzing the outcomes of the interviews it was detected that the companies are in process of implementing this RaDe process but they haven't entirely understood its differences of treatment yet. Some of them are more advanced and some others are facing more difficulties but all of them are having troubles to find a standardized path to follow. In fact, some of them do not see the necessity to have it as they see no clear difference with NPD. But what it has been discovered is that the companies who have more accurately defined the characteristics of RaDe concept are the ones who have a more standardized process. Therefore, it has been found that the key task when starting to implement a RaDe process is to build strong and robust criteria on what can be considered a RaDe process and how can be treated while carrying it out, so as to take the maximum advantage of the company's resources. Obviously, this is not the only required task to implement a different process in the company. When designing the process it is necessary to look on the strategy and the type of product the company is manufacturing. These two factors are seen in the practice as the ones that are going to differentiate RaDe process between the companies as they have a strong effect on the final process design.

Joining the theory and the practice it has been detected that being aware of the general factors that make certain projects the necessity to be included into a fast track process is the first step to build a standardized RaDe's process. That means detecting that these projects have low degree of innovativeness and hence spend fewer resources, and that are started mainly by a customer request and hence need to be delivered into a short period of time. This understanding is essential to move into the second step, define its uncertainties that are going to end up with the detection of what this project requires to be developed, and which are the main challenges and the main critical points that have to be overcome. Having these needs met now it's time to find how can be fulfilled, thus applying different techniques and hence building a specific and standardized process always having into account their strategy.

Along this thesis it has been evident that the task of differentiating these two concepts and implementing them in the companies is not easy at all and requires a high amount of time of research in the literature and even more time of implementation of the process inside every company, taking into account every single case with their respective needs. However, succeeding on creating a separated and standardized fast track process is not impossible and in this thesis is seen to be extremely necessary. Reducing costs and time becomes very important because today there are companies struggling to achieve a competitive advantage. As an unknown source said once, "*You learn how to walk but now it's time to run*".

## 6.2 Critical evaluation of the research

This thesis has tried to be made with the maximum objectivity basing all the statements in reliable references of books and articles. Moreover, this project talks about a topic which has a really wide scope and is affected by a broad number of different subjects. For that reason it has been attempted to follow a line of study that enables to create a general understanding of the processes without focusing attention in only one part of it. This has been challenging as a lot of interesting information was found related to more concrete concepts but was laid aside so as to not create so many ramifications and lose the study line. This fact together with the broad amount of available information might have overlooked some relevant factors that could be found in future studies.

In addition, RaDe process is a new concept that is currently being defined and is not widely utilized yet by the companies. That was a clear challenge during the project because it was difficult to gather the needed information on the literature review. Furthermore the interviewees did not have a complete understanding about what this concept meant. On the other hand, interviewing companies that already have acquired knowledge about the topic is seen also as a limitation as it was not possible to study the understanding of a company that parts from the scratch on this topic. Another detected limitation is that some interviewed companies didn't have the understanding of the process as a whole and focus their attention on the part they were experts, thus making difficult to comprehend the general framework of the company's practice. Finally, a last limitation has been the short range of the sample as the findings are based in four interviews and hence have made difficult to detect a common and reliable pattern in the companies' behavior.

## 6.3 Future research

Aside from trying to fix and minimize the effects of some limitations described above such as increasing the volume of the sample and making a deeper search for reliable information related to RaDe's process, some other concrete solutions related to the other limitations are provided below that can be considered interesting topics for future researchers.

As it has been said, it has been detected that the interviewed companies have some acquired knowledge about implementing a fast track process for certain projects. What would be interesting to do is to make more interviews to other companies that didn't have the experience and the knowledge acquired beforehand. It would be a good idea to analyze and compare them, trying to help them to standardize that concept in their companies at the same time.

In relation of the fact that some of the interviewees were familiar only with a part of the product development process, in company D for example the interviewees were more familiar about hardware development and they didn't have so much experience with software design, an interesting task to do is to interview people that come from different departments of the same company and that are in charge of different parts of the process (marketing, sales, software design, hardware design…) so as to see if they understand and treat NPD and RaDe concepts the same way.

Finally, another potential topic that could be interesting to be further studied is to compare NPD and RaDe process separating the analysis between products and services or between SME's and big companies, as it has been detected that they require different treatment.

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# 7 Appendices

Appendix A: Interview model

## Appendix A: Interview model

### Brief presentation of the project

Hello, my name is Berta. I am an exchange student currently doing my master thesis in the University of Oulu. I am studying the main differences between speeding up a New Product Development process and applying a Rapid Development process. Considering Rapid Development as a fast track project, started by a customer request, and which doesn't require as much effort to be developed as the New Product Development's projects. I am focusing my analysis on two main subjects, how are they detected in the companies and how are they treated within the process.

After having studied the literature I have detected some factors and now I would like to see if they are also detected inside the companies and if there are more. Therefore, I would appreciate your help on answering some questions about the topic so as to gather this information for my thesis. The following interview is structured into 4 parts: First of all I am going to ask you some background information about your company. Secondly, we are going to discuss about how is your NPD process understood and carried out. Thirdly, I am going to ask you some questions about how are RaDe projects detected and conducted. Fourthly, I am going to ask some comparative questions between NPD and RaDe projects and processes.

### Background information

1. Please tell me briefly about the company and business you are involved
   - 1.1. What type of business your company is? *(orientation)*
   - 1.2. Which kinds of products are you making? *(Products, services, products and services?)*
   - 1.3. Which kinds of products are you selling?
   - 1.4. How is your portfolio structured?

### NPD questions

2. Could you describe your NPD activities?
   - 2.1. How many NPD projects do you carry out every year?
   - 2.2. What is an estimated time to carry out an NPD project?
3. Could you explain me more about the process?
   - 3.1. Can you summarize the main phases of your NPD process?
   - 3.2. Have you detected any limitations or challenges in your NPD process?
   - 3.3. How do you think you can overcome these challenges?
   - 3.4. How have you involved your suppliers in NPD projects?
4. How are you coordinating NPD teams?
   - 4.1. Which are the main challenges on the coordination of the teams?
   - 4.2. How do you think you will overcome these challenges? *(Virtual communication?)*
5. Which are the main techniques you apply to accelerate NPD projects if needed?

### RaDe questions

6. Could you describe an example of RaDe / Fast track projects in your company?
   - 6.1. Which are the main reasons for applying a fast track process instead of NPD I this case?
     - Starting point
     - Degree of innovation, amount of development
     - Main departments that carry out the process

Delivery time *(short term, more speed?)*
Degree of risk on the process
Amount of resources needed to develop
Others?

6.2. How do you ensure product performance while making the process faster? *(Less gates, fast and less decisions…)*
6.3. Could you give me some examples?

7. Which are the main drivers of RaDe?
   7.1. In your own words, applying virtual communication will improve the process performance?
8. Which are the main challenges when applying a fast track process?
   8.1. Could you put me some examples?
   8.2. How can you overcome these challenges?
9. How have you involved suppliers in RaDe projects?
   9.1. Which are the main advantages of this kind of involvement?
   9.2. Which are the main disadvantages of this kind of involvement? *(Increasing the risk)*
10. In case of RaDe projects, how often you include the final product in the company's portfolio?
    10.1. How deep is the product's strategy fit studied in RaDe projects?

**NPD vs. RaDe**

11. How do you see the differences between NPD and RaDe projects?
    11.1. Applying cross functional teams
    11.2. Applying virtual communication
        11.2.1. Is that going to improve the process?
        11.2.2. Is that going to spend so many resources?
    11.3. Significance of applying a modular structure on the portfolio
    11.4. Uncertainty of supplier involvement
        11.4.1. Do you think that this issue is especially risky in one of them?
        11.4.2. Which one?
    11.5. Standardizing the process
        11.5.1. Is that going to improve the project's performance?